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THE AMERICAN GAS LIGHT JOURNAL

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The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

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[OFFICIAL NOTICE.]

Appointment of a Committee of Reception by the American Gas Light Association.

AMERICAN GAS LIGHT ASSOCIATION, OFFICE OF SECRETARY, PROVIDENCE, R. I., June 5th, 1893.

The following named members of this Association are appointed and respectfully requested to serve as a Committee of Reception, whose duty shall be to call upon all foreign gas engineers visiting our country during the continuance of the World's Fair at Chicago, whose names and addresses may be obtained, and to introduce them to other members of our profession, see that they obtain permits to visit the neighboring gas works and other objects of interest, and generally to make their stay in New York as pleasant as possible, and when they leave for Chicago, to give them letters of introduction to the Committee of Arrangements at Chicago: Messrs. Wm. Henry White (chairman), Eugene Vanderpool, William H. Bradley, Fred. S. Benson, William R. Beal, Jos. R. Thomas, Thos. F. Rowland, Jr., Fred. W. Floyd and Oscar Weber.

The Guild of Gas Managers and the Society of Gas Lighting are respectfully requested to co-operate with this committee in extending hospitality to our visiting professional brethren.

A. E. BOARDMAN, President.
A. B. SLATER, JR., Secretary.

[OFFICIAL NOTICE.]

The American Gas Light Association's Greeting to European Gas Engineers.

AMERICAN GAS LIGHT ASSOCIATION, OFFICE OF SECRETARY, PROVIDENCE, R. I., June 5th, 1893.

To the European Gas Engineers—Greeting: The American Gas Light Association will hold its 21st annual convention in the city of Chicago, beginning on the date of Wednesday, October 18th, 1893. It would give the members of the Association great pleasure to meet there as many of the European gas engineers and managers as can make it convenient to be in attendance at the World's Fair at that time. It is suggested that all contemplating visiting the Fair arrange their visits so as to be in Chicago, if possible, at the time of this convention, when they will be most cordially welcomed by the Association and invited to attend the sittings of the body and participate in its discussions of papers presented.

Those engineers who cannot conveniently visit the World's Fair at that time, but must choose some other date, are respectfully requested to send their names and addresses, as soon as they arrive in America, to the AMERICAN GAS LIGHT JOURNAL, No. 32 Pine street, New York City, so that a committee from the Association may be made aware of their presence, and when they may be met, so that they may form the acquaintance of their professional brethren in this country and be made to feel less like a "stranger in a strange land."

A. E. BOARDMAN, President.
A. B. SLATER, JR., Secretary.

BRIEFLY TOLD.

OUTPUT COMPARISONS FOR THE HALF YEARS ENDED JUNE 30, 1892-3.—A compilation of the replies to our inquiries, made for the purpose of determining the relative quantities of gas sent out in the first half of the current year and in the corresponding half of 1892, reveals a very satisfactory state of affairs in the gas industry. Circulars were sent to works at 80 different points in the country, and the test points were selected with a view towards securing an undeniably fair average.

This time none of the cities of the first class were appealed to, so it may be taken for granted that the figures given represent the state of the trade as it exists in the rough—that is, under circumstances other than those most favorable for its development. Out of the 80 separate inquiries made, replies were received from the proprietors of 54 works; and in no single instance did the semi-annual output exceed 70 million cubic feet. The total output of the 54 answering Companies, in the first half of '93, amounted to 1,080 million cubic feet, and the output at the same points in the corresponding half of '92 is returned at 996 million cubic feet; a gross gain of 84 million cubic feet, or a percentage gain of 9.22. This is a most satisfactory showing, indeed, and, looking between the lines of the replies at hand, it seems that a large part of the showing is traceable to the increased use of gas for purposes other than lighting. This looks to be all the more likely when it is noted that the number of separate meters in use shows an increase of 13.07 per cent. in '93 over '92. The average consumption of gas per meter seems to be 2,965 cubic feet for the six months of '93 as against an average of 2,757 cubic feet for the first half of '92. In 21 of the places reporting, a special rate on gas used for purposes other than lighting is allowed; and 17 of the plants report the operation of electric lighting annexes. In 12 of the localities a concession in the general gas rate was granted; the average of the 12 concessions amounted to, roundly, 15 cents per 1,000. It is to be understood that in these results no account is taken of gas used or sent out for public street lighting uses. We return our acknowledgment of the courtesy which prompted such swift and accurate replies to our inquiries, and the reading of the figures given cannot fail to impart to our readers the satisfactory impression that gas more than holds its own.

THE CITY FATHERS AND THE DETROIT GAS COMPANY.—In our current item columns (p. 337) will be found a lengthy abstract of the franchise which the local rulers of Detroit endeavored to foist upon the proprietors of the Detroit Gas Company as the price of their continuing to do business in that city. When one has read it over the most prominent impression resulting is that it is lucky for the Gas Company that the proverbial two must agree ere a binding bargain is struck; and we have no hesitation whatever in saying that no bargain will be made on this basis that shall receive the assent of the proprietors of the Gas Company. Gas at 80 cents per 1,000 net is a bad enough Morgan to begin with; but when to that meager allotment is added the stipulation that the Company shall pay to the city 5 per centum of its gross earnings, backed up by the further protestation that "if the average of said semi-weekly tests [of candle power] for any month shall fall below 18 candle power, as herein provided, then the amount to be charged for gas to consumers during said month shall be reduced *pro rata*," it would seem that all the city omitted to do on behoof of the consumer was to delegate to him the right of determining whether or not the gas averaged the requisite 18 candle value, permitting him to use his "naked eye" as the photometrical measurer. The city also fixes the rate the Company may exact for the laying of services, and also cuts out plenty of work for those engaged in the business of testing meters. Again, the Company's books, as well as "all governors, meters and works * * * shall at all times be subject to the inspection of the proper officers, to be designated by the Board of Public Works for such purpose;" the salary of the "proper officer," of course, to be paid by the Gas Company. As an exhibition of municipal gall (and Mayor Pingree has exhibited this feature of his composition both early and late in his dealings with the gas suppliers of Detroit) the franchise certainly deserves the prize. Still, as we said before, it takes two to make a bargain, wherefore it is reasonably certain that Mayor Pingree and his merry men will have to try their hand at franchise making again, and on very much more reasonable lines.

NOTES.—The City of Santiago, Chili, invites proposals for the lighting of its public streets and squares by means of electricity. The tenders will be opened in Santiago, at 1 P. M., December 30, 1893. Full particulars may be obtained by addressing the Consuls representing Chili in this city, Philadelphia, Boston or Chicago.——The Commission to determine the value of the Bay State gas plant (*in re* the proceedings under the Lyford act) are about ready to start the inquiry. Public hearings will be given.——Henry Rausch has instituted suit in the Common Pleas Court, Baltimore, against the Consolidated Gas Company of that city, for damages in the sum of $20,000. Rausch claims that while working for the Company, being engaged in excavating a trench, on the York road, between 20th and 25th streets, a wall toppled over and badly injured him. He claims that the accident occurred through the neglect of the man directing the work for the Company.——The tax paid this year on city account by the Cambridge (Mass.) Gas Light Company amounted to $11,968.72.

The Production of Illuminating Gas from Liquid Hydrocarbons by the Peebles Process.

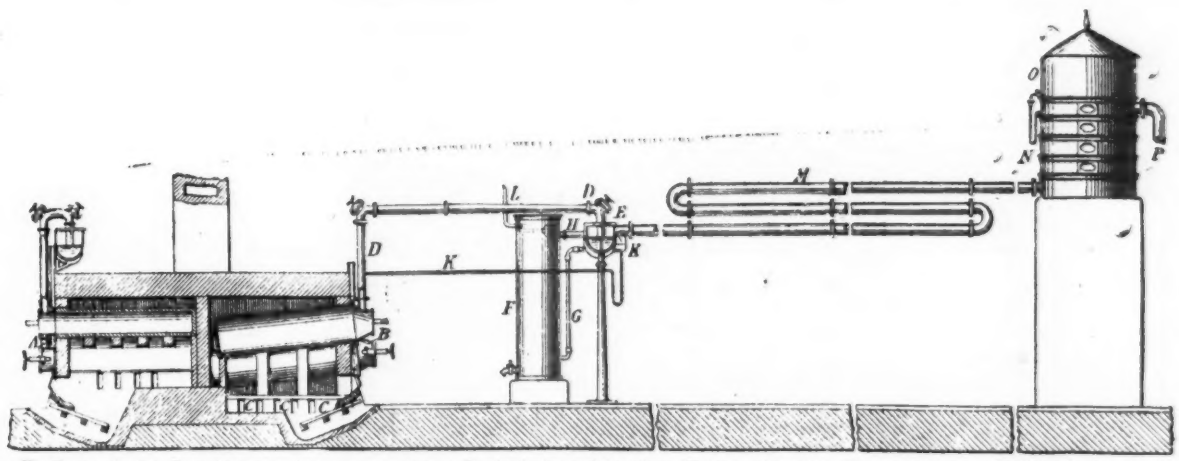
[A paper read before the North British Association of Gas Managers, by Mr. A. Bell, Jr.]

In the instructive paper to which the members have just listened, Mr. Young has communicated to them the principles of the decomposition of liquid hydrocarbons in the production of illuminating gas, and in particular those principles on which the Peebles oil gas process is based. It therefore only remains for me to explain the manner in which these principles have been carried into effect, and to give the results obtained from the practical working of the process.

Before proceeding, however, to describe the accompanying diagram I may state that, in the experimental operations conducted at Peebles, vertical, horizontal and inclined retorts were all used, also various forms of condensing and washing arrangements, each of which was found to be equally well adapted for carrying out the process. Of course, in practical working, the form and arrangement of the apparatus will depend to a great extent on the conformation of the works into which it is to be introduced, and the purpose for which it is to be used. Where, for instance, it is desired to economize space, the retorts may be vertical instead of horizontal; and so with the condenser, which, moreover, may be combined with the scrubber to form one piece of apparatus.

But perhaps the simplest of all arrangements is that shown on the diagram, which, with a slight modification, is actually the plant in operation at the Galashiels Gas Company's works. A glance at the diagram will show that the apparatus employed is very similar to that used for the ordinary manufacture of coal gas. The only differences, indeed, so far as the plant is concerned, are that the retorts are much larger than those used in the case of coal gas, that they are made of cast iron instead of fireclay, and that they are provided with valves and pipes for the admission of the oil; while, with regard to the arrangement of the apparatus, it differs merely in this, that each part in succession is placed above the other, in order that the fresh oil introduced at the top of the scrubber, together with the condensed products, may flow continually downwards until they reach the retorts. When we bear in mind what Mr. Young has said respecting the action of heat on hydrocarbon vapors, when it is communicated to them by direct contact on the one hand and by radiation on the other, it is evident that, in order to produce gas economically from oil such as is being used at Galashiels, the retort must be of such a form as to give the greatest amount of internal space with the least amount of surface. Now, the only convenient form of retort that approaches to this condition is that of a cylinder; for the surface of a cylinder is directly proportional to its diameter, while its capacity is proportional to the square of its diameter. From this it also follows that the greater the diameter of the retort, the smaller will be the surface exposed compared with the internal space. Besides, it is obvious that a retort of cylindrical form offers certain advantages—being easier made and being readily turned in its place should it become bulged or cracked by the action of the heat. Accordingly, the retorts shown on the diagram are cylindrical in form, and are as large as the size of the ovens would admit. They are 27 inches in internal diameter and 9 feet long; and, as you will observe, they are laid with a downward inclination equal to about half their diameter. You will further notice that they are placed back to back with an ordinary setting of coal gas retorts, the products of combustion from the semi-producer of which, after heating the coal gas retorts, are employed to heat the iron retorts, being sufficient to maintain the low temperature necessary for the decomposition of the oil. Attached to the front of each oil retort is a mouthpiece, provided with a circular door and an offtake pipe. The latter is joined to the hydraulic main in the usual manner, by means of ascension, horizontal and dip pipes. From the end of the hydraulic main, the horizontal condenser is carried with a slight inclination upwards, until it joins the bottom of the scrubber. The scrubber, which is one of the type originally designed by Mr. Young, and with which most of the members are acquainted, contains four trays, each of which is provided with the usual tubular openings and inverted tin covers. On the top of the scrubber is placed a cistern, for the purpose of containing the oil needed for scrubbing the gas.

In the working of the process, the temperature to which the retorts are heated necessarily depends on the nature of the oil that is being decomposed; but in every case it is considerably lower than that which has hitherto been employed when oil was gasified at one operation. For instance, with .885 "blue oil," which is being used at Galashiels, and has also been largely employed at Peebles, the most suitable temperature on the outside of the retort, with the retort producing an average quan



A, coal gas retorts; *B*, oil gas retorts; *C*, waste heat ports from coal retorts; *D*, stand-pipe and dip-pipe; *E*, hydraulic main; *F*, compensating and settling tank; *G*, oil outlet from hydraulic main; *H*, main oil feeding pipe; *K*, regulating valve and siphon pipe; *L*, fresh oil supply pipe and ball cock; *M*, horizontal condenser; *N*, oil gas scrubber; *O*, oil supply tank for scrubber; *P*, outlet of scrubber to oil gas meter.

tity of gas, was found to range from 1,200° to 1,300° F.; while the internal temperature, at a point in the center of the retort 4 feet distant from the mouthpiece, was from 900° to 950° F.* With blast furnace oil and coal tar, the temperatures are considerably higher. When the retort is in operation, the internal temperature is regulated by the rate of the flow of oil into the retort, and with each particular oil it varies within a narrow range; but the external temperature may vary through a wide range, according to the amount of work being done, or, in other words, to the make of gas per unit of time.

The retorts having been heated to the desired temperature, and the scrubber, the hydraulic main and the rest of the apparatus been charged with oil, the oil is turned on at the regulating valve *K*, and allowed to flow by the siphon pipe into the stand-pipe *D*, and thence along the inclined bottom of the retort. Now, if what was stated in the previous paper regarding the complex mixtures of the oils used and the varying boiling points of their different constituents be kept in mind, it will at once be evident that, as the oil flows down the inclined retort, these constituents are volatilized in the order of their boiling points at distances further and further from the mouthpiece, and that thus the vapors into which they are successively converted are subjected to increasingly higher temperatures for gradually longer periods of time. The rate at which the oil is allowed to flow into the retort depends, in a great measure, on the nature of the oil that is being decomposed—being greater in proportion to the percentage of carbon that requires to be eliminated; but the oil must flow at such a rate that only a part of it is converted into a permanent gas at a time, while the remainder, being but partially decomposed, leaves the retort in the form of vapor. The exact rate of flow, however, is readily ascertained by the appearance of the partially decomposed vapors, when a portion of the same is allowed to escape through a small stopcock fixed on the retort lid. These vapors, when in their normal condition, should be of a pale yellow or straw color; but, if the feed of oil be too small in relation to the temperature of the retort, the escaping vapors are more or less brown in color, owing to their being over-decomposed and loaded with sooty carbon—which, of course, is detrimental to the process, and would probably lead to choking of the apparatus. In practice, however, the appearance of the condensed oil when returning to the retorts, and the condition of the interior of the retorts when they are opened for removal of the coke, are sufficient indications to guide the workmen in regulating the flow of oil.

When the gaseous products leave the retort, they are met in the stand-pipe by the inflowing oil, and are practically freed from any sooty carbon they may carry in suspension. They are next washed, while bubbling through the oil in the hydraulic main, and there the least volatile portion of the partially decomposed vapors is condensed. The remaining products then pass on to the condenser and scrubber, where, by gradual cooling and washing, the most volatile but still condensable vapors are removed; and finally the remaining gas leaves the scrubber by the outlet pipe *P* in a thoroughly permanent condition. From the scrubber, the gas passes through a small station meter, after which it is mixed with the low quality coal gas at the inlet of the purifiers. During the whole operation of cooling and scrubbing the products from the retorts, the partially decomposed vapors are being gradually condensed—the least volatile first, the most volatile last; and as they become liquid, they return in an opposite direction to the hydraulic main, whence they pass by the pipe *G* to the compensating and settling tank *F*. In this tank any solid carbonaceous matter in the oil which would tend to choke the regulating valve *K* is allowed to settle; and, when necessary, it may be drawn off by a stopcock at the bottom of the tank. A supply of fresh oil equivalent to that which is being permanently gasified is automatically admitted to this tank, by means of the supply pipe and ball cock *L*; and this fresh supply, together with the condensed oil, flows through the main feeding pipe *H* to the regulating valve *K*, by which it is fed into the retort.

In this manner, the oil which is introduced into the apparatus, after serving as a washing agent to remove the condensable matter from the outflowing gas, finds its way into the retort, where, by the action of the heat, it is partially decomposed in the fractional manner described; and the resulting products, as they pass upwards through the apparatus, are simultaneously subjected to gradual cooling and condensing, and to the washing action of the down-flowing oil. By this means the permanently gaseous part only of the products, which has withstood the action of the final washing with the fresh oil that is periodically pumped into the scrubber, is allowed to pass away; while the condensable part is returned to the retort, and is again and again subjected to this process of alternate decomposition and condensation and scrubbing, with the result that the original oil is completely split up into permanently gaseous compounds and solid carbon, the latter of which is left in the retort in a hard and dry condition.

The working of this process is remarkably simple, and is so far automatic in its operation that very little labor is required. In the case of the Galashiels plant, the heating of the retorts is, as I said before, done entirely by the low heat from the coal gas setting; and there is thus practically no labor required in the heating of the oil gas retorts. In other respects, also, the works at Galashiels are well situated for carrying out the process. The oil is delivered in tank wagons on a high-level railway, and flows by gravitation into store tanks. From these it flows, also by gravitation, into the compensating tank, whence it is fed into the retort. The only oil, indeed, that has to be pumped, is that which is needed for washing the gas in the scrubber. Altogether, very little labor is required; all that is necessary, besides that already stated, being a little attention to the regulating of the flow of oil into the retorts and the withdrawing of the coke as it accumulates. Of course, more labor may be needed in some works than in others; but in all it will be exceedingly little, and very much less than that required for the manufacture of coal gas.

The plant having been described, and the working of the process having been explained, the members will now be desirous of gaining some information regarding the practical results of the process. Accordingly, I would ask their attention to this table, in which are summarized the results obtained from the decomposition of various oils differing in specific gravity and constitution. (See table on following page.)

With reference to the gases obtained from the "blue oils" and the crude shale oil, they are, as will be seen, exceedingly high in quality, and have a specific gravity of about 970 (air being 1,000). They require very little purification, as they contain only a trace of sulphureted hydrogen. Further, the coke from these oils is of a hard, dense nature, is very free from sulphur, and contains only 0.3 per cent. of ash, and it is therefore very valuable.

* These temperatures were determined by Siemens' copper ball pyrometer. In the case of the internal temperature, the copper ball was introduced by means of a tube fixed in the retort lid.

Name of Oil.	Specific Gravity.	Yield of Gas.		Illuminating Value.			Yield of Coke.	
		Cubic Feet Per Gallon.	Cubic Feet Per Ton.	As an Enriching Agent, Candles per 5 Cubic Feet.	Candles per Gallon.	Sperm Value, Pounds per Ton.	Pounds per Gallon.	Cwt. Per Ton.
Blue oil.....	.885	85	21,505	90.0	1,530	6,635	2.52	5.70
Do.	.845	86	22,790	93.8	1,613	7,329	2.09	4.94
Crude shale oil.....	.867	86	22,188	91.5	1,573	6,959	2.31	5.32
Blast furnace oil.....	.966	95	21,945	60.5	1,149	4,552	4.00	8.25
Splint coal tar.....	1.150	79	15,800	25.2	398	1,365	7.62	13.61

The results which are given for blast furnace oil are the average results obtained from the working of it at Peebles for over two months, during which time it alone has been used for enriching purposes. In decomposing this oil, no difficulty whatever has been experienced; but a higher temperature is necessary, compared with that employed in the case of "blue oil." The gas which it yields is also very free from impurities; but it contains about 13 per cent. of carbonic oxide resulting from the decomposition of the hydrocarbon compounds containing oxygen. The coke, although scarcely so dense as that from "blue oil," is likewise of considerable value.

In dealing with coal tar, the existing fireclay coal gas retorts at Peebles have been modified so as to adapt them to the principles of the process.

They also are laid with an inclination downwards, and the tar is admitted to the stand-pipe by a regulating cock and siphon pipe. It is run into the empty retorts at such a rate that the internal temperature is considerably reduced, and that only a small portion is converted into permanent gas—the remainder, after condensation, being returned along with the newly made tar again and again to the retorts, until the whole is finally converted into gas and coke. None of the difficulties hitherto met with when gasifying tar—such as choked pipes, etc.—have been experienced by this process; and the condensed tar in circulation, so far from becoming pitchy, actually becomes more and more liquid. A sample drawn from this tar in circulation yielded when distilled 10 per cent. of light oil, boiling under 400° F.; while the original tar contained only from 3 to 4 per cent. of such oil. The gas produced from split coal tar contains 10 per cent. of carbonic oxide, and about 1½ per cent. of carbonic acid and sulphureted hydrogen combined. The coke—a large quantity of which is produced—is easily withdrawn from the retort, and is also valuable as a fuel. The results in the table are the average results obtained from the gasification of the whole of the tar made from splint coal at Peebles during the past two months.

In coming to the question of the relative costs of enriching coal gas by means of liquid hydrocarbons and cannel coal or shale, there are so many modifying circumstances to be taken into consideration—such as the cost of crude materials, together with their carriage, the price of labor, the quantity and the quality of the gas, and the like—that it is impossible to give a detailed statement. But the results given in the foregoing table will enable each member for himself, after considering his own surroundings, to estimate the value of the process for his particular works. And, besides, the members, I have no doubt, are all familiar with the comparative statement of costs contained in the "Report on the Manufacture of Gas from Oil," by Mr. Linton, of Leith, which has appeared in the pages of our technical journals.

One thing I may say, before concluding, and that is that, whereas by all processes hitherto in operation only oils of a light and semi-refined nature could be used, by the Peebles process oils can be employed of whatever density and crudeness. This is no slight advantage, for while, in the one case, the supply of oil must be limited, in the other that supply is practically inexhaustible. When it is considered also that this matter of supply bears directly on the question of cheapness, it will be evident to every one, I think, that the Peebles process is of considerable value, as it will at the very least enable gas manufacturers to hold the balance between the two commodities employed for the enrichment of gas—between cannel coal, on the one hand, and oil on the other.

An odd accident at Dedham and Hyde Park, Mass., was the piercing of the local Gas Company's holder by a falling timber. The rent occasioned was sufficiently large to permit the escape of several thousand feet of gas.

The Yeadon Process of Gas Manufacture.

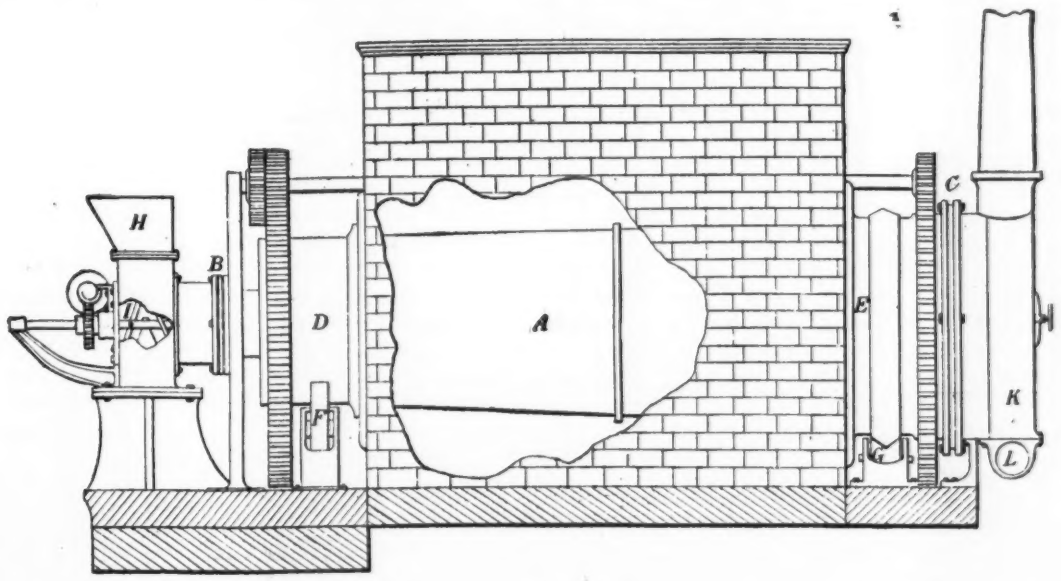
[A paper read by Mr. D. M. Nelson before the North British Association of Gas Managers.]

Throughout the entire range of apparatus employed in the manufacture of coal gas for illuminating purposes, there is no part of the process so important as the distillation and carbonizing department; for here it is that the gain or loss of the undertaking is determined. Yet, strange as it may appear, there have been fewer noteworthy improvements effected in the "retorting" of coal than upon any other portion of gas manufacture during the past thirty years. To tackle the mass of coal as ordinarily deposited in, and lying inert on the floor of the retort, lazily stewing into tars and liquors—involving enormous sacrifice of space and time, as well as waste of material—instead of passing off rapidly in a gaseous state, has hitherto defied the art of manual labor; while the skilfully designed machines intended to quicken the operation have been greatly baffled. Any process, therefore, which will effectually enable the external heat applied to the retort to permeate the charge, and so graduated as to accommodate any kind of coal, cannel or shale, and extract therefrom the maximum quantity of permanent gas of the highest illuminating power these substances are capable of yielding, deserves a ready welcome from gas authorities.

Knowledge, if we may so term it, pertaining to the distillation of coal into gas is very much in the nature of speculative theory, and is difficult of definition; but the waste going on within the retort is none the less real, and fatal to the obtaining of good results. Practically speaking, the gas retort may be regarded as a sealed book, because of the hidden and complex charater of its contents, and of the chemical changes which occur during the period, of from three to six hours, devoted to carbonizing. But in the abstract it is not difficult to infer that its full duty is far from being entirely developed, or that complete efficiency is not attained; for, as a matter of fact, the condition of the bye products amply testifies that the ordinary systems of distilling into gas are carried on at serious waste and sacrifice of material—involving superlative mechanical power, and human fatigue out of all proportion to the benefits derived.

It is universally admitted that the primary duty of a gas works manager is to manufacture *gas*, and to produce it *speedily*, saving time and labor; *largely*, yielding a profitable return; and of *good quality*, giving satisfaction to the user—not creating excess of tar, naphtha and coke, and thereby contributing to the inevitable discomfort of over-production and the self-inflicted damage and loss resulting from glutted markets. While the gas retort may be termed the drudge of the household, it is also regarded, and very properly so, as the breadwinner of the family; and it is in this relationship that I desire to arrest your attention for a few minutes, as I describe to you a distinctly novel and the most efficient form of retort for economically and destructively distilling coal, cannel, or shale into gas that has ever been employed on a thoroughly practical scale, capable of being installed in any gas works, where the annual make exceeds 10 million cubic feet, while for a less quantity it would of itself be capable of producing more than the maximum required, and, however employed, with an ease and comfort hitherto unknown to the anxious gas manager, free altogether from the slavish drudgery so common with the ordinary gas ovens.

The Yeadon revolving gas retort requires very small space—say, about 15 ft. by 10 ft. by 9 ft., or only one-eighth of the room occupied by ordinary carbonizing plant calculated to produce an equal quantity of gas; for instance, from 28 single fire clay retorts set in 4 ovens, containing 7 retorts each. It will be observed from the drawing that the space usually required for charging and drawing tools and machinery is saved; and when we consider the high—indeed, the too often exorbi-



tant—prices paid for land near towns where gas works are generally erected, coupled with the saving in the height of walls, and the superficial area of roofing, it will be seen at once that the gain is simply enormous when compared with the expenditure upon such buildings as are required for ordinary retort benches.

As will be noticed from the drawing, the apparatus consists of a conical-shaped retort *A*, revolving on two gas tight glands (one at each end) *B* and *C*. The retort proper measures 8 ft. in length and 2 ft. 6 in. in diameter at the narrow end or back *D*, and 3 ft. 6 in. in diameter at the front end *E*. It revolves on four friction rollers *F* and *G*—two at the back and two at the front. The rollers marked *F* are square on the edge—giving freedom ; while the rollers marked *G* are V-shaped, so as to keep that end of the retort in place, and assist the gas-tight gland *C*. By an arrangement at the back end in gland *B*, the retort may expand longitudinally, which it does, but without interfering with the efficiency of that gland. At the inlet of the back end there is a hopper *H*, fitted with an archimedian screw (or knife blades) *I* which conveys the coal into the retort. The interior of the retort is fitted with six taper blades or wings, which run parallel with the retort, and serve the purpose of breaking up and mixing the charge—an essential part of the process.

While revolving, the conical shape of the retort causes the charge to be gradually worked along to the front or discharging end *K* (and it occupies only about 12 minutes in doing so), where the resulting coke or ash is passed through the exit pipe *L*, into which is fitted an archimedian screw, similar to that at *I*, and thus delivers it into trucks, or sends it out directly to the coke yard. At the back end of this pipe there is a jet of water, which constantly drenches the coke, and also prevents any escape of gas. Of course, there are the usual ascension pipe and hydraulic main, which latter it is proposed to dispense with. The retort itself is made of iron, as are also the glands and all other parts ; and the force required to cause it to revolve is 1-horse power nominal. This retort is capable of carbonizing from 12 to 15 tons of coal per 24 hours.

To save complication of figures, I have here a simple table showing the make and sperm value ; the figures being the average of 24 separate tests, on a practical working scale. In these experiments we used one ton of unscreened coal, and had 15,855 cubic feet of 22-candle power gas ; showing an increase of 5,551 cubic feet, and 5-candle power, over that obtained by the ordinary process with screened coal.

Ordinary Process.

Coal yields	10,700 cubic feet.
Sperm.....	408 grains.
Sperm per ton.....	623.65 lbs.
Illuminating power.....	17 candles.

Yeadon Process.

Coal yields	15,855 cubic feet.
Sperm.....	530.88 grains.
Sperm per ton.....	1203.44 lbs.
Illuminating power.....	22 candles.

From these figures, any gas manager may easily calculate the gain such a retort would be to him in his working, even as an auxiliary. From *shale* the increase is immensely greater and more profitable. That subject will form interesting matter for another paper.

The resulting coke is of no worth as fuel, being incombustible ; but it is of equal money value, as it can be utilized for fire-proofing, and making a first-rate non-conducting cement, also for fine surface asphalting. The tar takes the form of a crude pitch ; but while in the hydraulic main it has the consistency of a heavy tar, only assuming the form of pitch when exposed to the air. In the liquor well will be found a small quantity of tar of a very light, watery nature, with practically all the hydrocarbons extracted. As to the ammoniacal liquor, it is only about half the usual strength, caused doubtless by being deprived of a large quantity of its illuminating gas before reaching the tar well.

The gas made by this process is thoroughly permanent, as was proved last February, when we put 50,000 cubic feet of it into a holder, where it remained undisturbed for three weeks. On being tested at the end of that period, it was found to have lost only a quarter of a candle, and 20 cubic feet of its bulk—a loss so trifling as to be easily accounted for at that season of the year. Whatever is lost in tar, coke and liquor, therefore, is more than compensated for by the increased quantity and quality of the gas, not to mention saving in labor.

As I have no desire to exhaust the subject, or to weary you by a lengthened reading (preferring rather to suggest inquiry such as may lead to discussion), I conclude by summarizing as follows: Being able to produce gas in 12 to 13 minutes is of infinite value during periods of fog and dull weather, and on the occurrence of mishaps or repairs, especially so when the demand for gas light is sharp and excessive. The value of such an apparatus, capable of carbonizing any quality and kind of coal during a period of scarcity and difficulty in obtaining the ordinary supplies, will be manifest. By this process the system of enriching poor gas by oil, etc., is rendered unnecessary; almost any coal being made to yield the desired illuminating power. There is no trouble from the deposit of carbon in the retort, or from choked ascension-pipes, the worry of gas managers. The enormous saving and convenience, in being able to heat up the retort in 4 instead of in 48 hours, as required by ordinary retort ovens, is obvious. Sunday ordinary labor and night work are reduced by about 75 per cent.; while it will abolish overwork and payment for overtime, also casual and foreign labor. All the foregoing advantages and many others too numerous to detail here, are palpable gains, and cannot be overvalued, either financially or socially, in the economy and utility of manufacturing gas.

Discussion.

The President intimated that Mr. David Terrace was an authority on the subject dealt with in the paper.

Mr. Nelson said his reason for not introducing Mr. Terrace's name was that experiments carried out by that gentleman and others were entirely independent of the process, and were made for the benefit of the gas industry ; all the parties interested being banished from the premises.

Mr. D. Terrace (Middlesbrough) remarked that, besides Mr. Nelson, he was the only one present who was acquainted with the process; and anything he had to say about it he had embodied in a paper which he read before the North of England Gas Managers' Association in April last. But he was not able to get such results as Mr. Nelson had portrayed. The coal they used was Thrislington; and they obtained from it about 12,000 cubic feet of 18-candle gas, which was two candles more than they had in the ordinary way, and did not show any great enhanc

ing value in the Yeadon process. Of course, he could recapitulate his own paper—in fact, Mr. Nelson only recapitulated it—in respect to the points of advantage in the Yeadon over the ordinary process. But until it was really practically at work, which the plant from which the results now before them were obtained was not (because Mr. Nelson referred to its exposure to the weather), it was impossible to say what it could do. There were certain things which had to be found out. This was quite a new apparatus, and would require to be thoroughly tested. He was going to mention the subject of coal analysis, in which it was very wisely said that the conditions of the tests ought to be stated. If they could bring their results up to this, it would need very careful working. He had recently had a circular handed to him which said: "Believed to be correct, but not guaranteed." He took this to be owing to the favorable action of the Association on past analyses. It was rather strange that they should have the two processes in juxtaposition —the Peebles process and the Yeadon process. It was very evident there was something in the coal which they wanted to get out, and which they did not just now; and he trusted the two subjects they had had before them would spur them in the direction of enhancing the products of the coal in the ingredients they dealt in.

Mr. John West (Manchester) said he had carried out some experiments on the subject before the meeting. About 25 years ago, he thought, he made some trials with a little machine into which he dropped coal from a hopper. He had an ordinary clay retort, closed at either end. In that retort he spread the coal in an even layer on the bottom; and he certainly obtained some very large volumes of gas—from 12,000 to 13,000 cubic feet per ton of Newcastle coal. He had, as a product, a thin layer of a very light coke. He was certainly enraptured with the results; but, after an extended experience, he found that the fuel required was rather exorbitant. This was a question he would like to put to Mr. Nelson—as to the amount of fuel used per ton of coal carbonized by the Yeadon process. He found that he lost a great deal by the radiated heat; there being a large exposure of ironwork at either end of the retort. Of course, it was a very different system from the one before them; although it appeared to him there would be a little similarity. His retort was stationary. The volume of gas he obtained was very good, and of a permanent character. A number of his friends in the South saw it working; but after it had run for some time, he did not proceed with it, because he could not make it quite satisfy his friends in the matter of pounds, shillings and pence. He spent a considerable amount of money on the process, and gained much information, which he stored up and applied in another direction. He thought the Yeadon process was worthy of their consideration and trial. He believed in trying all these things, and ascertaining what they could get out of them. It was good for all of them, if they were to arrive at a right conclusion. He had not seen the Yeadon apparatus; and therefore he could not form an opinion as to its mechanical and economical efficiency. The temperature to which it was subjected would severely test it; but he thought they might take it that this retort had entered into the "region of practical politics," and that, as time went on, they might hear whether it had turned out good, bad or indifferent.

Mr. J. Ballantyne (Rothesay) said he noticed that Mr. Nelson had not given them any information as to the cost of the process. If they were to get no better results than Mr. Terrace had obtained (and if there was no coke, how were they to heat the retort?), this would make the process very expensive. Perhaps Mr. Nelson could give them some information on this point.

Mr. J. B. Terrace (Brechin) remarked that one thought had occurred to him while listening to the paper before them, and that was why Mr. Nelson, who was a Scotchman, and lived among Scoth cannel, did not use some of their high-class cannel coal in his retort. If he obtained such high results from a mixed or small coal, which ordinarily yielded 17-candle gas, and 22-candle gas with his Yeadon apparatus, they might get 60 or 80-candle power out of the first-class cannel they employed. With regard to the mechanism of the machine, he thought it was a very ingenious one. He saw that water always had to be poured upon it to keep it cool. He thought, looking at it, that it was worth a fair trial. He did not like to condemn anything before giving it a thorough trial; and not only one, but many trials.

The President said he did not know that he could add anything to the discussion further than the remarks he had made in his address; but he thought no one, looking at the drawing and the results, could question for a moment that there was really something in the Yeadon retort. A revolving retort was not a new thing, though it certainly was new as far as gas making was concerned. Revolving retorts, however, were used in other processes; and a retort which he had himself seen working in some of the Cornish mines, for roasting tin and copper ores, was not unlike the one before them. The calciner there was set on a level plane, and the fire traveled through the tube. Of course, in making gas, they must keep the flame outside the retort. This had been accomplished; and by tapering the retort, they secured the motion or travel of the material. He thought the secret of the Yeadon retort was that the coal was treated in the same way as the oil in Mr. Young's process. Mr. Young had been successful in cracking the oil in very small particles; and the patentee of the Yeadon retort had succeeded, in a manner, in cracking up the coal in the same way, in very small particles. He should like to ask Mr. Nelson if he experienced any difficulty in keeping up the proper heat of the retort—in keeping it continuously working (say) for a week at a time; and also whether there was any difficulty in getting the coke to come out. There was one good feature of the retort, and that was that there was no moving parts inside it. Various methods had been tried; but, as far as he could see, it was impossible to get any material that would stand the temperature at which they had to carbonize coal—from 1,800° to 2,000° F. The great advantage of the retort was, he thought, its capability of treating dross and small shale. There were enormous piles of this, as they saw when traveling over the country. In times of strikes, it might be a question whether the Yeadon retort could not be profitably employed in working up these vast heaps of refuse. He would like to ask Mr. Nelson one other question. He could easily suppose that, by cracking up the coal in the Yeadon retort, it would be quite possible to get 15,000 cubic feet of gas from a ton; but he could not understand the last line of the table. He could easily see how an extra quantity of gas could be obtained; but the additional candle power seemed to be difficult to accept. He was sure Mr. Nelson could explain this; but he had overlooked it.

Mr. Nelson, in replying, expressed his obligations to the various speakers for their criticisms of his paper. He said his friend Mr. Terrace had stated that he had tried in the retort a coal that was recognized in Yorkshire to be the toughest and most disagreeable for gas managers to work. They adopted the plan of using a coal that was largely employed in gas works in Yorkshire farther south than Middlesbrough. They used Aldwarke Main coal. This was a very much higher type of coal than the Thrislington which Mr. Terrace dealt with. He mentioned this to explain why Mr. Terrace did not get anything like parallel results. They found that the better the quality of the coal they worked with, the higher were the results they obtained. For instance, they had used shale; and they had an immensely increased result. Then they tried cannel; and they also had an increase that was quite enormous. He might likewise state that they sent up from one of the shale heaps in Scotland a wagon load of shale, which yielded 6,000 cubic feet of 24-candle gas. At the present time these heaps of shale were an absolute waste, cumbering the ground; and the officials of one of the oil companies in Scotland had said that they would be very glad if they could have theirs removed. It was necessary they should understand there was no discrepancy between the remarks of Mr. Terrace and his own; for the simple reason that coal of a different character had been experimented with. On this account, he might say that the illuminating power they obtained from working the coal was derived from the large proportion of naphthas, benzoles and other properties of the coal they turned into gas. No naphthas or light oils were found in the tar well. There was nothing but ammoniacal liquor. With reference to Mr. West's remarks, he might say that the heat was so low at the port that they could put their hand upon it; and the heat bearing upon the retorts was only applied to about 5 feet of it. It differed from an oil or any other retort in the fact that it did not buckle or blister. Because of its revolving there was no unequal draw upon it; and the heat was equal. The retort, which had been in use for two years and a half, was as smooth on the surface now as on the day it was put in. With reference to Mr. Ballantyne's remark as to the want of fuel, such as coke, they had an arrangement by which they heated the retort by its own gas, on the Bunsen principle. They found that the gaseous fuel was better than Leeds coke. The expense would be greater, in the exposed position in which the retort was, than if they had fitted it in a confined space. He might say, however, with regard to the question of cost, that he made a calculation, which showed that something like 50,000 cubic feet of gas could be put into the holder at 6¼d. per 1,000 cubic feet. Assuming that they did this, instead of having four ovens of seven retorts, each producing gas, they could make a calculation of the one as against the other. With reference to the price paid for the apparatus, it was rather less—£700, perhaps, as against £800 for retort building and other apparatus, and the structural portions required for the retort house. All the difference between this apparatus and the experiments which had gone before was that in the Yeadon process there was no heat to warp the fittings. There was no difficulty whatever in keeping up the heat. In point of fact,

they found that it was less variable by the Yeadon process than it was in ordinary retorts ; and as to the ejection of the coke, he might tell them that it came out just like sand—there was no congestion and no difficulty was experienced in its falling out. With reference to the bearings, he might say that the water spoken of had nothing to do with the bearings. It was not used to keep them cool, it was to quench the coke and it helped to seal the gas and prevent it escaping.

The Physiological Effects of Currents of High Frequency.

By H. Lewis Jones, M.D.

The application to medicine of electrical currents of great rapidity of alternation, or high frequency currents, as they are commonly called, has occupied the minds of medical men to a great extent during the past 12 months. In France especially is this the case, where D'Arsonval has given much study to this difficult subject. The demonstrations which were given at the Royal Institution by Tesla in the spring of last year left an impression upon the minds of many people that enormous voltages were harmless to the human body if only they could be made to alternate with sufficient rapidity, and people were astounded at the spectacle of a lecturer placing himself in a circuit carrying a current alternating some hundreds of thousands of times per second, at a pressure of many thousands of volts. These experiments, coming not long after the accounts of the execution of criminals by electricity in America, with pressures of 1,200 or 1,500 volts, and compared with the occasional notices in the newspapers of fatal accidents to workmen engaged upon electric light cables at 1,000 volts, made it seem as though the rapidity of alternation was the factor which protected Tesla from injury by the enormously high voltages which he was handling. The same view is taken by D'Arsonval in his papers before the Societe de Biologie. He there describes an apparatus consisting of an induction coil supply current to Leyden jars, the jars being made to discharge through a circuit including a helix of 10 to 15 turns of thick wire and an air gap. In this way there is set up in the circuit a succession of sudden rushes of current, which oscillate hundreds of thousands or even millions of times per second, the rate being determined by the Leyden jars ; and the wire helix becomes the seat of electro magnetic induction effects, comparable exactly to the induced primary currents of a medical induction coil, but very much more intense. These induced currents of the helix are the subject of D'Arsonval's experiments. By attaching wires to the beginning and end of the helix, the induced current or extra currents can be led off ; their energy was sufficient to bring to full incandescence a lamp requiring two amperes to light it, and it was therefore assumed that they had a magnitude of two amperes. The electromotive force of the currents was at least 8,000 or 10,000 volts, because they were able to leap across an air gap of several millimeters, and yet their effect upon the tissues of the body was very slight ; in fact, they were hardly felt.

Now it is certain that a current of far less than 1 ampere, either steady or alternating 20, 50 or 100 times per second, would produce unbearable and dangerous shocks in its passage through the tissues ; and the inference drawn is that the extreme frequency of alternation can render a current of dangerous magnitude innocuous. But I am not satisfied that such an inference is a proper one, for the following reasons :

1. A Leyden jar discharging through the body, produces effects which are painful and severe, as all who have felt them will agree ; but yet this is a discharge of high frequency of alternation ; in fact, it is by the Leyden jars in the circuit that the oscillatory character and the rapid rate of alternation of the discharge is determined. Oliver Lodge gives the rate of oscillation for a pint sized Leyden jar at ten million per second ; for jars of greater capacity the rate is less rapid.

2. The high frequency and high potential discharges of Tesla's apparatus are not altogether harmless, but can produce severe shocks and can kill small animals, as Elihu Thomson has shown. The discharges from the terminals of such an apparatus can produce severe muscular contractions even with the resistance of a considerable air space interposed in the circuit ; so much so, that in some recent experiments which the writer was enabled to make through the kindness of Mr. Campbell Swinton, it was considered prudent to proceed no further with the experiment of actually touching both the terminals of the coil at once.

3. It is very doubtful whether D'Arsonval's estimation of the magnitude of the current of his apparatus is correct. The incandescence of a lamp filament with currents of high frequency has been recently under discussion in some of the electrical journals, and a very satisfactory explanation of the phenomenon has been forthcoming. It is well known that for alternating currents the resistance of a conductor is greater than it is for steady currents, and the increase of resistance rises rapidly as the rate of alternation becomes greater ; and with frequencies approaching 1,000,000 per second, the effective resistance of the lamp used by D'Arsonval would be raised enormously; this would require the energy needed to bring it to incandescence to be applied at a proportionately higher voltage, while the magnitude of the current would be lessened in an equal degree. For example, the energy of 2 amperes at 100 volts is the same in amount as that of 0.02 of an ampere (20 milliamperes) at 10,000 volts.

We are, therefore, able to say that the current which raised D'Arsonval's 2-ampere lamp to bright incandescence was very much less than 2 amperes, and was probably only a few milliamperes, and herein lies the pith of the whole question. The experiments with high frequency currents of high tension are harmless if the magnitude of the current is small, and as the high potential is, in fact, obtained at the expense of the current, this latter diminishes in proportion as the potential is raised by each successive step-up in the transforming apparatus. For the present, it may be taken as not yet proved that high frequency of alternation can render electrical currents harmless ; and it may still be accepted that the effect produced by the passage of a current through living tissues depends primarily upon the magnitude of the current, as measured in amperes, which is made to traverse them, and upon its density or concentration therein.

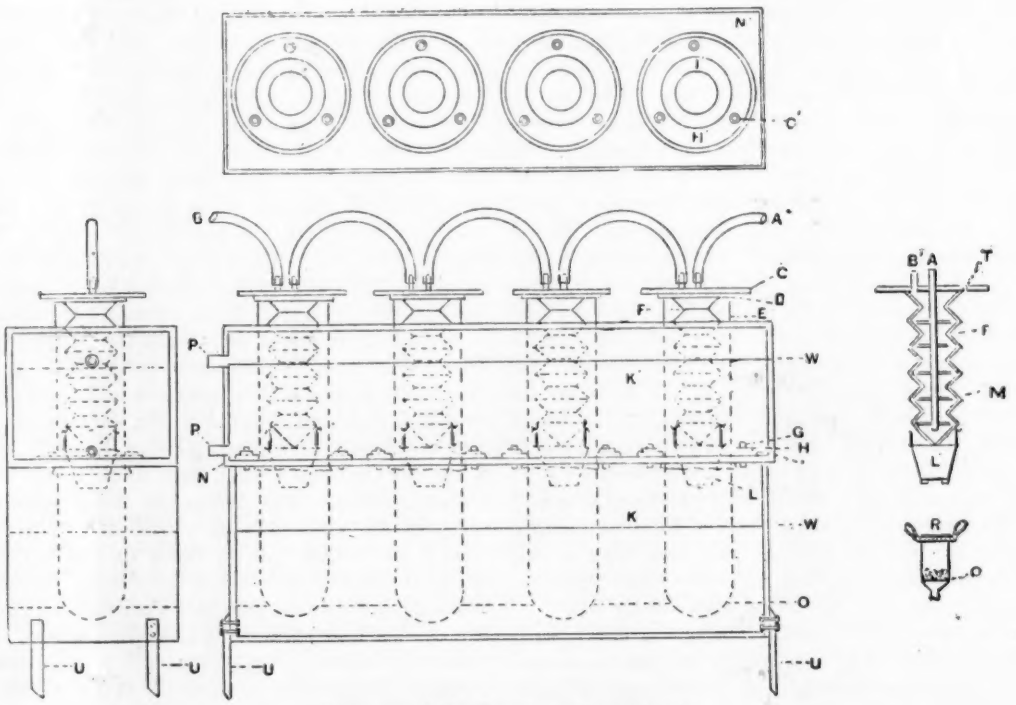
Portland Cement Manufacture in China.

Considerable quantities of Portland cement are manufactured at a place called Tongshan, about 80 miles from Tientsin. Consul Brennan says that the raw materials used at the Tongshan works are mountain limestone, fire-clay, marl, and a rough kind of China clay, all of which are found in the immediate neighborhood of the works. The fuel used is hard furnace coke, made on the premises from the local bituminous coal. The process of manufacture is somewhat more elaborate than that adopted in the Thames works, much greater care and attention being necessary to ensure the production of good Portland clinker. The limestone and clays have first to be reduced to an almost impalpable powder. Their respective analyses being ascertained, it is then passed through the brush mill, from whence it is pumped into the "backs," to be eventually moulded into bricks for burning into cement in the kilns. The greatest possible care has to be exercised at the washing part of the process, by reason of the limestone and clays being so variable in quality as it is delivered into the works, an analysis of the slip being necessary every half hour or so. Owing, however, to the different densities of the raw materials used, they settle down in the "backs" in their distinctive strata, and before the brick moulding can be done, it is necessary to thoroughly turn over the "slurry" with the shovel, and tread it well under foot in order to obtain a uniform mixture. The bricks are then transferred to the drying ovens, and in due time taken to the kilns for conversion into Portland cement clinker. Nothing but true clinker is ground at the Tongshan works. The resulting Portland cement is of great density, viz., 158 pounds per bushel. The present output is 300 tons per week, and that is the limit of the capacity of the works. It is all used at the various works of the Imperial Government, viz., harbors, forts, Yellow river embankment, railways, arsenals, etc., very little finding its way into the hands of private consumers. There is every probability that the demand will soon be largely in excess of the existing works. The cement is guaranteed to yield a tensile strain of 400 pounds per square inch, after having been immersed in water for seven days ; and, as a matter of fact, it invariably tests much higher. Every day's work is tested in the following manner : The man in charge of the grinding draws a sample from each pair of millstones every half hour. At the end of the day the whole is mixed uniformly and taken to the testing room. It is there tested for fineness, and 12 test briquettes are made from the same, 23 per cent. of water being used in gauging the cement. After standing in the moulds for 24 hours—note having been made of the time occupied in "setting"—the briquettes are each marked and placed under water for seven days, each being examined from time to time for any signs of blowing or shrinkage, the usual glass test being adopted as well ; at the expiration of this time they are taken direct from the water and tested for tensibility and compressibility in patent cement testing machines. If the cement passes the tests it is handed over to the storekeeper for delivery. At the time of delivery it is again sampled and tested, and a record of each test is kept. For some considerable time difficulty was experienced in obtaining cement of uniform quality. It was no easy matter to get the ignorant Chinese coolie to understand the absolute necesity of accuracy and carefulness in every stage of the process. No reliance whatever could be placed upon the native foremen, nor any assistance expected from them, their ideas

being as lax and crude as those of the coolie. But by dint of perseverance and keeping to one set of men, something like system has been established, and the work technically proceeds with the utmost satisfaction, the output being as uniform in quality as it is possible to obtain anywhere. The fuel (furnace coke) employed in the kilns was also a great source of trouble at first. In order to effect its combustion, a very free passage of air is necessary, but unless the greatest care is exercised at this stage of process, the heat produced is so intense that complete fusion at once takes place at the very bottom of the kiln, thus shutting off all draught—in other words, the decarbonization and subsequent fusion of the upper layers of the kiln are arrested. By the introduction of air passages throughout the depth of the kiln, this difficulty has been completely overcome, and the even and uniform clinkering of the entire mass is now effected with great regularity, 48 hours being sufficient for a 90-ton charge. Owing to the severity of the winter, it is impossible to do any mixing for four months in the year, so that the output is limited to about 9,500 tons per annum. The works are in full swing 16 hours a day, including Sundays.

On an Improved Extraction Apparatus.

Mr. H. W. Wiley, in a recent note on an apparatus for the extraction of substances soluble in ether, alcohol, etc., which apparatus was described in the *Journal of Applied Chemistry*, February, 1893, asserts that the device can be more conveniently operated when constructed in the following manner:



Improved Extraction Apparatus.

It is convenient to have the bath for holding the tubes made in two separate portions, K and K'. The box K can be conveniently made of galvanized iron with legs, U and U', of any convenient length, so that a lamp can be placed underneath the box.

The liquid to be used in the bath may be water or other substance of different boiling point, and should stand at the height represented by the line W.

The box has a false bottom represented by the dotted line O, with circular perforations to receive the bottom of the extraction tubes, as indicated. Both sides of this box are conveniently made of glass or mica so that the operator can see the progress of the evaporation of the solvent.

This box K' is to rest lightly on K, but is not fastened to it in any way. It is also conveniently made with one or both sides of glass or mica. The bottom of the box carries rubber diaphragms, perforated to receive the extraction tubes, through which the tubes pass water tight. The plan of the bottom is shown in figure H' N' G'. The rubber diaphragms are held by two brass rings fastened together by small bolts. One of these rings is placed below the perforated bottom and one above. The perforation of the rubber diaphragms is shown at I'. An end view of the box is also shown at the left of the illustration. This box has exits, P and P', so that water can be allowed to flow in a thin film over the bottom and escape at the exit P, or if the exit P be closed the water can be made to rise to the level of P', as shown by the line W'. The outside of the test tubes can in this way be surrounded with water, or if a lower temperature be required fragments of ice can be dropped in. The object of this is to condense the vapors of the solvent which may strike against the sides of the tube and thus tend to rise to the top and escape at the intersection of the metal plate and the ground glass rim of the tube.

The baths are made of convenient size to hold four of these tubes and the condensers can all be cooled with a single stream of water entering at A, and after passing through the four condensers escaping at B. A section of the condenser is shown at the right of the illustration. The water enters through A', and passing upward round the disks M is thrown to the outside of the condenser and escapes at B'. The vent at T is left open until the vapor of the solvent has filled the interior of the apparatus when it is closed.

The material to be extracted may be held in the perforated crucible L' or an ordinary glass extraction tube, R, Q, with a perforated platinum disk fused into the glass at Q, and carrying an asbestos felt, can be employed. The upper part of the glass extraction tube has a little flange on it to support a looped wire, by means of which it can be hung to the hooks on the condenser in the same manner that the crucible is supported.

The advantage of using glass is that the operator can see every thing which is going on in the extracting tube.

When the apparatus is to be used with ether, the box K' should be lifted up from K and the extraction tubes thrust farther through the diaphragm, until at least one of the corrugations of the condenser passes below the diaphragm. Otherwise the ether will be largely condensed on the sides of the glass test tubes and will run back down the sides instead of being collected on the condenser and dropped into the extraction tube. The box K', for this purpose, can be held on any convenient support.

When ether is used the vent P is closed and the one at P' left open and a stream of water is made to flow into the box at the end opposite P', so that the water in K' is continually changing. This avoids any objectionable loss of ether by its escaping at the top of the apparatus.

When 80 per cent. alcohol is used for the extraction the vent at P is to be left open and sufficient water allowed to run in at the end opposite P to keep the bottom of the box K' cool. The vapor rising from the box K is condensed by this cooled surface so that it drops directly back into K. When alcohol is used the box K' should rest directly upon K.

With 80 per cent. alcohol the boiling point of water is not quite sufficient to secure a rapid evaporation of the solvent. A mixture composed of two parts of glycerol and one part of water will be found most convenient for this purpose. Inasmuch as many of the substances extracted by alcohol give up a large quantity of matter to the solvent, the boiling point is therefore considerably raised and the glycerol bath is necessary in this case to secure a sufficiently rapid evaporation. To avoid any danger of bumping with such alcoholic solutions, it is convenient to add a few fragments of platinum foil.

The residues in the test tubes can be dried and weighed in the tubes or the amount of the extracted matter can be determined by weighing the crucibles or glass tubes containing the matter to be extracted. The latter method is preferable, with perfectly dry substances, inasmuch as it is possible, especially with ether, that some bodies may be extracted from the material which are subsequently volatilized during the drying of the extract. Whenever it is desired to weigh the extract, especially the ether extract, it may be received in a small cylindrical glass vessel with flat bottom, 4 to 6 cm. high, and of a diameter just permitting its introduction into the extraction tube. About 10 cc. of mercury are first poured into the extraction tube on which this vessel rests. The necessity of weighing the heavy test tube is thus avoided and the extract is more easily dried in the small vessel.

This construction of the apparatus is compact, occupying but a small space; is easily manipulated, requiring but little attention, and is economical in respect of the use of gas, a single lamp being sufficient to operate a bath containing 4 tubes. It has the additional advantage that all parts are open to inspection, so that the progress of the extraction can be watched at all times if necessary. It also has the advantage that both the extract and the residue can be weighed and thus a check on the results be obtained. The volatilization of the solvent should be so regulated as not to accumulate any liquid in the extracting tube.

Berlin Suggestions for the Electrical Congress.

C. E. Gillaumme, according to the *Western Electrician*, advises that the suggestions of the American Institute of Electrical Engineers have been discussed at Berlin, as well as at Paris, by a committee of the Electrotechnical Society and by the Society itself. The opinions that have been voiced differ materially from those which have been expressed here [Paris], and it is to be feared that our American confreres are decidedly opposed to the points on which we French and Germans are agreed, so that a general agreement can probably be reached only in the case of a few questions. We will consider the discussion of the topics as it took place in Berlin, eliminating that relating to the ratifications upon which there is a general agreement.

Naming of Certain Magnitudes.—The vicious expressions which the Americans propose to suppress, such as converter, direct current, etc., are especially English, and it seems unnecessary to mention them. In regard to the phrase "impressed electromotive force," the committee of the Berlin Society confesses, as we do, that it does not understand its exact meaning. The committee then proposes that the electrical vocabulary shall not be discussed at all in the International Congress, but that it shall be arranged as it is judged best in each language. This proposition is too radical, in our opinion; if in the case of the old words, like widerstand (resistance), we cannot ask our German confreres to adopt the Franco-English form, at least we can hope that in the case of new words, such as reluctance and permittance, the root may be adopted without modification. They already have the German word "reluktanz," and there is no reason why there should not be adopted a common vocabulary which is so much needed to-day.

Units.—The Matthieson modernized standard has been as unfavorably received at Berlin as in Paris. The "gauss," the "weber," and the "oerstedt" have had the same fate for the same reasons that were brought forward in the Society of Electricians.

In regard to the "henry," the Berlin report says: "We do not feel the need of giving to the quadrant the name, but we are ready to honor a fellow-countryman of our American friends."

The reciprocal unit of the ohm appears necessary, but says the report: "We should wish to see adopted to designate it some other expression than ohm, which is obtained by mutilating a highly honored name. We should like to give to it the name of the man who proposed it, which we could do the more easily as he has lost it himself. We propose then to name the unit of conductance the Thomson."

When we speak of personal qualities we cannot say too much in this connection, and it may be added that this name suggests to everyone that of a leader in the science of electricity, but the name of Thomson is already employed to designate a galvanometer and there might be confusion when it was said that a Thomson was found in a circuit. The evil would be avoided by dropping the last syllable, as has been done in the case of Faraday and Volta. The ohm would thus become the thom. But here again we would have an honored name mutilated. Let us follow the teaching of the old proverb that says that of two evils choose the less, and adhere to that form which is already in use, the ohm. The names of Gauss and Siemens (the latter suggested for the first time) are entered for the next unit needing a name. And Weber? Will he ever have so many units that his name will no longer be in competition?

The Unit of Light.—Tests made during many years have shown that the form given by Siemens to the Violle standard does not yield a satisfactory result, especially if thin bands of platinum are employed. The natural conclusion would be apparently that a return should be made to the Violle standard, either in its primitive form or in some other form that should appear preferable. The Berlin Electro-Technical Society, however, thought that the Hefner-Alteneck should be substituted. According to M. Hefner-Alteneck, however, the complete study of his lamp has necessitated many years of assiduous work, and it would be necessary to begin it anew if in pursuance of the American suggestion its dimensions are modified in a way to make them those of the bougie decimale.

The essential difference between the mechanical or electrical units and the unit of light lies in the fact that with the former (with the exception of the three fundamental units) the unit precedes the standard, while in the case of the latter it cannot be defined without an arbitrary standard. From this arises all the trouble. We have tried to overcome it by defining as follows an illumination, or, more generally, an absorbed radiation. The radiation received by 1 c m is made a normal spectrum which is divided in sections of 0. I μ. In each of these divisions the unit is the watt.

The brightness is equivalent to the illumination, and the luminous intensity is its integral of surface. This latter can be without difficulty incorporated in the C. G. S. system. The adoption of an independent unit of a standard will greatly facilitate the choice of the standard.

Notation.—While the suggestions concerning the adoption of as uniform notation as possible have excited only an echo in France, they have been seriously discussed in Germany. The abbreviations of the International Committee on Weights and Measures are very generally employed, and most scientific publications have abandoned those vague abbreviations c c, c c m, c q, q c, m c, c b m, the least fault of which is that they are ambiguous.

Although we have given up breaking lances systematically for cm^2, cm^3, mm^3, etc., we are no less ready to seize this occasion to recommend once more to our confreres, directors of periodicals or scientific writers, the general adoption of a rational system of prefixes and exponents, so that an abbreviation may be immediately understood without any explanations.

The table compiled by M. Hospitalier is approved in the main, but some modifications have seemed desirable—for example, the designation of velocities by u, v, w, acceleration by $\dot{u}$, $\dot{v}$, $\dot{w}$, the moment of coupling by D, etc. Finally, it is proposed to distinguish in the abbreviations kilogramme-mass and kilogramme-force. The first would remain kg, and the second kg* or kgg. We have had proposed heretofore the abbreviation kg *g*, the sole advantage of which lies in its strict accuracy, but its use would complicate composition somewhat. Dolivo-Dobrowolsky failed to see the necessity for distinguishing between forces and masses in writing, as, in his opinion, confusion was impossible, but the majority was not of his opinion. It seems to us, also, that there might be some advantage in the use of this abbreviation.

The Coal Field of Logan, W. Va.

Mr. Jed. Hotchkiss, writing in the *American Manufacturer* about the development of the Logan coal fields, says:

It is but a short time since the Norfolk and Western Railroad completed its extension to the Ohio River, at Kenova, and, by obtaining control of the Sciota Valley Railroad, succeeded in establishing a great through line of its own from Norfolk, on the Hampton Roads, to Columbus, O., and at the latter point establishing connections which make it a portion of a great trunk line from the Atlantic seaboard to all portions of the central and farther West. In the course of its passage across the Atlantic highlands, it traverses the whole width of the great Appalachian or Ohio River coal basin in Virginia, West Virginia and Ohio, in which two of the great coal measures, the Lower and the Mid-

dle, have their greatest development, where their best beds are accessible above the drainage levels of the country, and where they present the most favorable conditions for easy and profitable mining; so that, in a little more than a decade, the Norfolk and Western has come to the front as one of the large coal furnishing railways of the country, and its coals have become more widely known and more in demand than any others that are now furnished to the great markets of this country and even to some of other countries. To mention its Flat Top (Pocahontas) coal is to name, as shown by the results of experience, the best steam making coal that is now known and in use. The coke made from that coal has secured a reputation second to none for all metallurgical purposes.

In its westward progress, this railway has reached and crossed the semi-bituminous coal field of the Lower Coal Measures of the Virginias, and for its steam and coking coals it has established an enviable reputation. In its farther progress westward, it has recently entered into and crossed the bituminous coal field of the Middle Coal Measures, and now the coals of that field are just beginning to appear in the markets of both the East and the West, as gas, steam and domestic coals from the splints, the cannels and other varieties of bituminous coal that are distinctive of the Middle Coal Measures. At various points on this westward extension coal mining operations have been begun and such shipments as characterize the early stages of development in all coal mining regions are now being made. One of these points that will in the near future become well known in the markets is near the head of the West Fork of Twelve Pole River, near Dingess Station, in Logan county, W. Va., in what will be known among the miners as the Logan coal field, and its coal as the "Logan coal," naming it from Logan county, W. Va.

The Guyandot Coal Land Association, the shareholders of which are mainly representative men of England, Scotland, New York, Pennsylvania and Virginia, is the owner of a large portion of this Logan coal field. It has already made quite a number of leases in the vicinity of Dingess, a station about 70 miles up from the Ohio River, at Kenova, to men who have heretofore been coal operators in Pennsylvania and other States. One of these lessees, "The Pearl Mining Company," the principal men of which are Messrs. McCafferty & Morrison, of East Brady, Pa., will be the first to ship coal from this field. Their mine is now open and their tipple ready for use. They are only awaiting the completion of a short spur from the Norfolk and Western to begin the shipment of coal. In a recent letter to the writer, under date of June 20th, these gentlemen say: "We are opening our mines on the double entry system, with a view in the future of putting in rope haulage. Our mine going under the right hand mountain is now about in 600 feet, and the one under the left hand mountain about 200 feet. This second entry will parallel the main entry driven on the face of the coal under the right hand mountain, and this, when driven up, will complete the double entry system in that mine. We are anxiously awaiting the completion of the switch. As soon as it is completed we are ready to ship coal and will push our work so as to increase our output very fast. We expect to be shipping 10 cars per day in three months from the time the switch is completed, and 30 cars per day in one year from that time."

There are several coal beds above water level at Dingess, but the one in which mining operations will begin is that known in the Kanawha region of West Virginia and in the Cincinnati markets as the Campbell Creek coal; standing in those markets on an even footing and selling interchangeably with the Youghiogheny, or Pittsburgh, coals of Pennsylvania. This coal is found near the center of the Middle Coal Measures, and is known in Pennsylvania as the Lower Kittanning. It is known in the Kanawha Valley, at different mines, under the names of Campbell Creek, Peerless, Coal Valley, Hawk's Nest, etc.

As mined at Dingess this coal bed appears in three benches with two thin slate partings and having a thickness of 56 inches. An analysis of samples of this coal, by its benches, was recently made by Dr. Henry Froehling, the well known analyst of Richmond, Va., with the following results:

	Moisture, at 212°.	Vol. Comb. Matter.	Fixed Carbon.	Ash.	Sulphur.
Upper bench..	1.30	41.47	54.78	2.45	0.805
Middle bench..	1.15	43.15	53.31	2.39	0.605
Lower bench..	1.22	39.88	55.65	3.25	0.688
Average per ct.	1.22	41.50	54 58	2.60	0.699

Messrs. McCafferty & Morrison write me: "We are highly pleased with the result of these analyses. They fully confirm the opinion we have steadily held to as to the quality of our coal. It is second to none for all purposes except coke, and in that the deficiency is not in quality, but rather in quantity. The high percentage in volatile matter cuts down the percentage of coke. For steam, gas and domestic purposes it has few equals and no superiors. The low per cent. in ash is remarkable. * * * We do not anticipate any trouble in finding a ready market for all the coal we can get out; coal of this quality is always in demand."

This is a very superior block or splint coal, one having a very bright and shining fracture and solid structure, and that will bear shipment for almost any distance without breaking up. It is affected but little by the weather, so it is well suited for stocking. In Cincinnati and other Western markets it is the coal that is most in demand for gas making, steam producing and domestic purposes. The writer is confident that the amount of coal sent from the Logan field before the expiration of another year will be quite an important item in the transportation of the Norfolk and Western, and in the coal trade of the country.

Hydraulic Cements and Concrete.

Mr. Alfred O. Doane says that in the construction of electric light and power stations it is of the utmost importance that firm foundations be provided in order to secure the best results. As cement enters largely into the construction of foundations for buildings, machinery, etc., a few words on the subject of cement and its uses may prove of interest.

Two principal varieties of hydraulic cement are used in engineering work—natural cement, also known as American, or Rosendale cement, and Portland, or artificial cement. The former is made by burning a shaley limestone in kilns and grinding the clinker produced with burrstones to a very fine powder which, when mixed with water, soon sets and forms an artificial stone nearly as hard as the original rock.

Portland cement is made by combining chalk, or some other form of limestone free from magnesia, with silicious clay; these materials are intimately mixed and made into bricks which are burned in kilns with coke fuel at an intense heat. The resulting clinker is ground in the same manner as natural cement, and is much stronger and sets quicker than Rosendale cement.

In using cement it is important to determine its quality, as, owing to the process of manufacture, it is liable to considerable variation. Cement is also injured by dampness or by keeping too long before using.

The tests usually applied are, first, to determine the firmness of the cement, which is very important, as only the finest dust has any hydraulic qualities; the coarser particles acting like sand. A small sample, about 4 ounces, is passed through a sieve having 2,500 meshes per square inch; the residue remaining on the screen should not exceed 8 per cent. for American or 5 per cent. for Portland cement. Some engineers also use a screen with 10,000 meshes per square inch. In this case the residue should not exceed 18 per cent. for American or 15 per cent. for Portland cement.

The other test is for tensile strength.

The cement is make into briquettes, in molds having a central section of 1 square inch. The cement may be mixed with water alone or with varying proportions of sand. These test pieces are kept in water, after they have set for 24 hours, 7 days, or 1 month, according to the length of the test desired; they are then broken in a machine designed for the purpose, and the force required to pull them apart noted in pounds per square inch.

A good American cement should have a tensile strength of at least 65 pounds per square inch, 24 hours test without sand. For Portland cement, under the same conditions, 125 pounds should be required.

One of the largest uses for hydraulic cement is in making concrete. The material consists of a mixture of cement, sand and gravel or broken stone. It is much used for foundations of all kinds. It is more durable in moist ground than brickwork, and is, of course, all in one piece, with no joints to fail or leak; it is easily laid and is considerably cheaper than brick or stone masonry. The strength and quality of concrete depend largely on the care and skill used in laying it, and in rightly proportioning the materials used.

The proportions commonly used are as follows:

One barrel cement.

Two barrels sand.

Four to five barrels gravel or broken stone.

The sand should be sharp, gritty and free from loam, dirt or fine sand. The gravel should contain no pebbles which will not pass through a 2½ inch ring. The sand and cement should be well mixed, dry, then enough water added to make a stiff mortar. The stone or gravel is then moistened and thoroughly mixed with the mortar by turning over in the bed with shovels and hoes; this should be done three or four times. The concrete is then shoveled into wooden molds of the shape desired. In order to obtain the strongest work the concrete should be laid in 6-inch layers, as dry as possible, and have it work well, and each layer

well rammed until the water flushes the top. In order to make a foundation extra strong and bind it together, old iron rails or rods are sometimes incorporated in the mass, and dowels for holding cap stones or engine beds could be inserted in the soft concrete in the same manner.

Concrete should be allowed to set for 24 hours at least before moving molds or disturbing it in any way. If laid in cold weather it requires much longer to set, and if the temperature is below freezing the sand, stone and water should be heated and the work covered from the frost until entirely set.

By the use of concrete in connection with a timber crib-work, heavy foundations may be successfully placed in very treacherous ground, such as quicksand or peaty soils.

New applications for concrete are being found all the time and a knowledge of its valuable properties will often be of use in all branches of engineering.

Heating by Electricity.

Mr. Campbell Scott, in a paper on this subject, remarks that such a quantity of electricity is necessary in operating electric railway systems that the loss of a small portion of it is but a minor item to electric railway managers, and from the start they showed an eagerness to adopt any method possessing so many conveniences as electricity for heating their cars and making them comfortable and attractive to their passengers. At the present time at least one-fourth of the electric railways of this country have their cars heated by electricity, and from what I can learn a very satisfactory result is accomplished at but a very slight cost.

The method employed is very simple, which is as follows: Underneath the seat of the cars, in three or four locations therein, one of these electric heaters is placed and a small portion of the electric current used in operating the motors of the cars is diverted through the heaters. The general method employed in this new form of heating device for heating cars is as follows: The frame of the heater is generally about 8 or 10 inches high, about 6 inches thick and about 3 feet long. A special "plaster" is made, looking something like porcelain, when hard, in which very fine, especially prepared wires are embedded from one end to the other in zigzag fashion. The entire surface of the plaster is in this way embedded with the resistance wire, with the two ends of the wire protuding at one end, while in some cases several plates of plaster with these wires embedded therein are employed, after which the plaster substance is applied to the exposed surface of the wire, thoroughly encasing them therein. After this has been done, the whole substance is cooked until it resembles the hardest porcelain, with enamel finish. The exterior metal case, with legs underneath, is placed around this, and with sundry finishing touches we have an electric stove or heater.

It must be understood first, before I describe the method by which the heat is produced through the above mentioned medium, that electricity always flows in what is technically known as a "circuit," *i. e.*, the electric current, after being developed from a generating source, must return to the same source. In other words, electricity will not flow or operate unless this circuit is maintained, for as soon as the circuit is broken the flow ceases. Any metal will conduct electricity to a greater or less extent, but some metals possess the capacity of conveying a given amount of electric current with a far less loss than others. When we attempt to convey electricity through a bad conductor, we seem to "cramp" the electric current, and it seems that a great friction takes place therein, which causes heat. In other words, when an electrical conductor retards the passage of the current the conductor is heated and the greater the resistance offered by the conductor to the passage of the current, the greater is the intensity of the heat produced. Copper is considered one of the best conductors and offers but little resistance to the flow of the electric current, while such metals as platinum, German silver, etc., are termed poor conductors, and on this account offer great resistance to the current's passage, and consequently, in them, the current produces heat. In electric heaters above described, very poor results would be obtained if the wires employed therein were composed of copper, which offers a very low resistance to the passage of the current, while the best results are obtained from the use of fine, especially prepared wire, which offers a very high resistance to the current's passage and consequently causes the production of heat. This special resistance wire being imbedded in the plaster is practically protected from the outside air, and a very high heat is produced, which is conveyed to the enamel, the intensity of heat being governed by the quantity of this resistance wire employed, also by the quantity of current which flows through it. For several years a number of inventors have been at work endeavoring to so perfect this system of heating that it will be available for many of the commercial and domestic uses where small heated surfaces are necessary.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

SUPERINTENDENT COWDERY, of the Milwaukee (Wis.) Gas Light Company, has good reason for believing that gas for cooking purposes can be popularized, and he believes so from the fact that 7,000 gas stoves have been placed in that city and are in use at the present time. Of this total, 2,600 were placed since January 1, 1893. It is calculated that the Company's sendout by December 1, 1893, in the half of the 24 hours, commencing at 6 A. M. and terminating at 6 P. M., will be exactly equal in volume.

THE Hazelton Boiler Company, of this city, has recently sold one of its 200-horse power boilers to the Providence (R. I.) Gas Company, mention of which sale recalls to mind the fact that the Hazelton boiler is doing good work in the power rooms of the Consolidated Gas Company, of New York, as witness the following admissions made in respect of it by Mr. William H. Bradley, Engineer in Chief, in a letter written to the Hazelton Boiler Company under date of May 3, 1893:

The Hazelton Boiler Company, 716 E. 13th street, New York City: Gentlemen—The four 250-horse power each, Hazelton or Porcupine boilers erected by you at our 21st street station during the summer of 1891, have been constantly in use for about 18 months, giving entire satisfaction in every respect. When they were erected we arranged a system of piping and valves that would enable us to use a forced blast, if required. We have never been obliged to use a blast, and burn, with a natural draft, anthracite pea and dust, coke screenings, coke dust, coke breeze, cinders or partially burned coal from our generators, without any trouble whatever. The boilers will steam freely with the cheapest kind of fuel—a fuel that we were unable to use in our horizontal tubular boiler furnaces. Before deciding to use this type of boiler I made a lengthy investigation as to their merits and adopted them in the face of strong opposition, and it gives me great satisfaction to be able to state that I have never regretted my action at that time. On the contrary, I was so much pleased with their performance that I ordered four more of 200-horse power each, to replace six horizontal tubular boilers at our 44th street station. Two of these were erected in the fall of 1892, and were in use through the winter of 1892-3, giving unqualified satisfaction; the other two are now being erected. By this change we have 800-horse power on the floor space formerly occupied by 480 horse power—a marked gain where room is an object. I note also an improvement in the temperature of the steam at the generators. The boiler pressure of the horizontal tubulars previously used was 80 lbs.; of the Hazeltons now in use, 100 lbs. From the experiments of Regnault we find that steam at 80 lbs. equals 324° F.; at 100 lbs. equals 338° F. The mean of four experiments in each case was, viz.: From the horizontal tubular boilers, with an initial pressure of 80 lbs., a temperature of 245° F. at the generators—a loss of 79°. From the Hazelton boilers, with an initial pressure of 100 lbs., a temperature of 323° F. at the generator—a loss of but 15°. This is probably explained by the fact of the upper tubes in the Hazelton boilers acting as superheaters, and that the steam leaves the boiler hotter and drier than in the case of the horizontal tubulars. I shall be pleased at any time to show and recommend your boilers to anyone you may refer to me. Yours, etc., W. H. BRADLEY, Engineer-in-Chief Consolidated Gas Company.

SOME time ago we noted that the Spencer (Mass.) Gas Company asked the town to compensate it for damages to its gas mains occasioned by the town's use of a heavy steam roller during the macadamizing of Main street. The Selectmen have declined to admit that the town was responsible, and the Company will now briug suit to enforce its claim.

MAYOR MATTHEWS has signed contracts with the Bay State Gas Company giving it the lighting of the streets in South Boston, Dorchester, Roxbury and the city proper. The contracts run from July 2, 1893, to July 2, 1896, or until a new agreement is made. The city is to pay 10 per cent. less than is charged to ordinary consumers in the districts named. The rate at South Boston and Dorchester is $1.30; Roxbury, $1.20; Boston, $1. The contracts also include the lighting of all public buildings, parks and public grounds.

THE Hempstead (L. I.) *Inquirer*, dated Aug. 25, had this to say respecting the progress of the tunnel under the East river, through which gas manufactured at Ravenswood is to be delivered for distribution in New York city sooner or later: "Work on the tunnel of the East River Gas Company has again stopped until the engineers can make a test of the ground they are working in. It is feared that in order to successfully build the tunnel they will have to abandon all that they

have done, and sink their shaft 150 feet deeper to strike solid rock. This will prove an awfully expensive mistake if such a step becomes necessary, and will occasion great loss of time, as the work has progressed about one-third the distance under the river."

THE plant of the Mutual Fuel Gas Company, 76th street and South Chicago avenue, Chicago, was damaged by fire the other day in the sum of $2,000. The plant is housed in a two-story brick building, the lower floor of which is used for offices and machinery. An overheated journal set fire to some waste, and the flames spread to the woodwork on the second floor before they were extinguished.

ACCORDING to the Chicago *Times* of August 25, an application will be made to the City Council for a franchise for an opposition Gas Company, which will operate under the Rew patent water gas system, which process is controlled by the National Gas and Water Company, of Chicago. The ordinance which the Company will ask the Council to pass will provide that of the Company's paid-up stock of $30,000,000, one-third, or $10,000,000, shall be transferred to the city of Chicago as a consideration. Another third, $10,000,000, is to be given as a bonus with a like amount of bonds sold to raise money to construct the works. The remaining third is to be owned by the promoters of the Company. Of the seven directors of the Company, the Mayor is to be one, the Council is to elect two, the owners of the bonds are to elect two, and the promoters of the Company two. By this means the city would always be in position to prevent the transfer of the Company to or its combination with any other existing Company. Another plan of stock distribution the promoters are willing to consent to is $9,000,000 to the city, $9,000,000 as a bonus for bonds, $9,000,000 to the promoters and $3,000,000 to the Chicago University for the establishment of a school of chemistry, manual training and metallurgy. The ordinance provides that the price to be charged to consumers shall not exceed $1 per 1,000 cubic feet gross, or 80 cents per 1,000 if paid for before the 15th of the month. Sale of the franchise is prohibited, as is also combination with other companies. It was believed that the application for a franchise would be made at the meeting of the Council to be held to-night.

MR. M. S. HART, Oil Inspector for New Mexico, during one week in August inspected 7,200 gallons of kerosene oil at Santa Fe, and was obliged to condemn something like two-thirds of it because it failed to show the stipulated fire test under the laws of the Territory.

EXTENSIVE additions are being made on the purifying plant of the Citizens Gas Light Company, of Newark, N. J.

THE authorities of Thomaston, Me., have made a contract with the Knox Gas and Electric Company for the public lighting of the village by means of arc and incandescent electric lamps.

MR. CLARENCE H. HANNELL, of Newcastle, New South Wales, a large shareholder in several of the great mining properties of that country, left San Francisco for his home some days ago. Prior to his leaving he was visited by the reporter of a local newspaper, who desired some information regarding the outlook for coal shipped to San Francisco from New South Wales, as to prices, etc. Mr. Hannell said: "While I was in Chicago a fortnight ago I received advices that the price for coal would be reduced on January 1, 1894, from 10 shillings to 9 shillings per ton, that is to say, for best screened, sound coal. For some time there has been a strong combination among the principal collieries which fixed the price of the product at 10 shillings. In this combination are the Walls End Company, the A. A. Company, the Newcastle and the Lambton; but there are two big concerns and several small ones which refused to come in. For a time they, too, held up the price, but of late they have cut just far enough under us to get away considerable of our trade, and we propose now to fight them until they cry quits. At 9 shillings we will manage, I think, to come out even, while the outside companies will have a small deficit. Yes; 9 shillings will be the price for some time after the first of the year, and I do not think the fight will be over in a twelvemonth." Mr. Hannell's remarks on the situation were then submitted by the reporter to one of the leading local coal merchants, with a request that he state his opinion about what the effect of this reduction would be on the San Francisco market. The dealer said: "The direct effect will be to save 25 cents a ton to consumers of Australian coal. The collateral effect will be to weaken the market in the Seattle and British Columbia product a trifle. The large consumers here, after long experience, have found what quality of coal best suits their need, and for a small and probably temporary drop in the price they would not change. It would take a deeper cut than 25 cents a ton to affect the San Francisco market seriously."

SOME days ago the Finance Committee of the City Council, of Wheeling, West Va., met for the purpose of devising a scheme for an increase in the city revenues, which were far from being sufficient to keep the ball rolling—that is, were woefully inadequate to meet the just demands of the city's creditors. The bright particular cause of the deficiency was, of course, the municipal electric light plant, which was eating up all the income derived from the municipal gas works, and which, as one Alderman put it, was likely to eventually bring the city to ruin. After lengthy discussion, the City Solicitor was asked to report as to the right to levy a direct tax to pay the expenses of the electric light plant. If this is finally determined upon the authorities will have performed a tardy act of justice towards the gas consumers, who so far have paid directly the cost of lighting the streets by electric arcs, which we presume shine alike in Wheeling on the gas consumer and on those who do not use gas.

THE plant of the Capital City Gas Company, of Des Moines, Iowa, has been overhauled this season. The expenditure incurred amounted to $25,000.

THE Concord (N. H.) Gas Light Company's semi-annual dividend of 3 per cent. has been payable since the 1st of the month.

MR. JOHN R. HILLS has been awarded the contract for the construction of the handsome new office building to be erected by the Hartford (Conn.) Gas Company.

THE Lowell (Mass.) *Mail* says that the Lowell Gas Light Company is erecting at the works on School street a plant for the manufacture of water gas. It will be upon an experimental scale only, at present, and the extent to which it will eventually be adopted will depend upon the success of the experiment.

THE Fire District Committee of Westerly, R. I., has entered into a contract with the Westerly Gas and Electric Light Company under which the latter agrees, for the term of 5 years, to maintain 65 incandescent lamps in a certain specified district, at a rental of $15 per lamp per annum.

THE Kansas City (Mo.) *Times*, of recent date, says that an entirely new proposition for a franchise to lay mains and operate a gas plant in that city will shortly be laid before the City Council. It is asked by lawyer Grant I. Rosenzweig, in his own name, for the benefit, he says, of a syndicate of Eastern capitalists. The names of the men for whom he is acting are, Mr. Rosenzweig says, known only to himself, and he declines to make them public at present. The proposition is in the main drafted after the plan of the Kansas City Gas Light and Coke Company's request for a 30 year franchise which is now in the hands of the Council. The main points of difference are that he proposes to furnish gas cheaper and pay the city a larger percentage of the receipts. The Company asks a franchise for 25 years to do business in all parts of the city, beginning at the expiration of the present Gas Company's franchise, Feb. 25, 1895. It proposes to sell gas to private consumers at $1.25 per 1,000 cubic feet, if the total amount so used does not exceed 250 million cubic feet per year. When the total output exceeds that amount there are to be gradual reductions until it reaches 700 millions cubic feet, when the rate falls to $1 per 1,000. The Company asks to be allowed to charge a penalty of 10 per cent. when accounts are not settled within 10 days from the presentation of the bills. Gas used by the city for street lighting is to be charged for at the rate of $15 a year on the moonlight schedules, or $22 a year for all night. For gas used for other purposes the city is to pay half the rate charged to private consumers. For this privilege the Company proposes to pay into the city treasury 4 per cent. of its gross receipts for gas sold to consumers other than the city—the present Gas Company agrees to pay 3 per cent. If a similar franchise is granted to another Company the obligation to pay a per cent. of the receipts is at once cancelled. The next section declares that the franchise is not to be exclusive. If the city makes a change in grades the Company is to change its pipes and mains to conform to it. The Company is to report to the city between the 1st and 15th days of March of each year the amount of gas sold during the previous year, and on this basis the rates are to be arranged for the succeeding year. At the end of 25 years the city is to have the privilege of buying the plant at an agreed price, if a price can be agreed upon; if not, at a price to be determined by five appraisers. Two appraisers are to be selected by each party and a third by the four selected. Two of the appraisers must be civil engineers, residents of other cities of more than 100,000 inhabi-

tants in the United States. The Circuit Court can appoint appraisers if the interested parties fail to do so. If the franchise is granted an acceptance must be filed within three months and a bond within four months, but no provision is made as to when work shall begin. "The men I represent," said Mr. Rosenzweig, "have ample capital, and, with one exception, live in the East. Several of the capitalists are already interested in large gas plants. We want to get a franchise as soon as possible in order to begin work and get the plant in readiness to operate when the franchise of the present Gas Company expires."

In the ordinance proposed by the authorities of Detroit, Mich., for the government of the Detroit Gas Light Company, the five initial sections relate to permission to operate a gas works in the city; to the manner of laying the main pipes, services, etc.; to the supervision that the Board of City Works may exercise in respect of the main laying, etc.; to specifying where the pipes may be laid, and to paying the expenses of an inspector on behalf of the city by the Company. Sections 6 and 7 also relate to matters closely identified with the matters above noted. Continuing, the ordinance provides: "Sec. 8. The said Company shall not charge or receive any higher rate than the following for gas furnished to the inhabitants of said city: For manufactured gas, 90 cents per 1,000 cubic feet, with a discount of 10 cents per 1,000 cubic feet if paid at any time during the month following that for which a bill is rendered by said Company. For natural gas, 33 cents per 1,000 cubic feet, with a discount of 3 cents per 1,000 if paid at any time during the month following that for which a bill is rendered by said Company. Sec. 9. A bill shall be rendered to each consumer by said Company before the 15th day of each month for the gas used by such consumer during the preceding month, which bill shall state the number of consumers' meter, the number of cubic feet of gas used by such consumer during said month, as shown by said meter, the average illuminating power for the month, the amount due the Company at the rate herein specified, and the discount to which the consumer is entitled if paid befoae the end of the month, as provided. If any person or persons supplied with gas neglect or refuse to pay the amount due for the same, said Company may stop the gas from entering the premises of such person or persons, so long as owned by the person in arrears. In no case shall the officers, servants, or employees of the Company remove a meter from the premises supplied by the Company unless by consent of the consumer, without first giving, in writing, a forty-eight hours' notice, by leaving the same at the premises of the consumer, and said removal shall take place only between the hours of 8 o'clock in the forenoon and 2 in the afternoon. *Sec.* 10. The price to be charged for gas by said Company shall be uniform and the same to all consumers, and any reduction made in the price or cost to any person or persons shall furnish a legal right on the part of any other person or persons to demand gas at the same cost or price. *Sec.* 11. All service pipes shall be maintained by said Company to the lot line of consumers. Said Company shall be entitled to charge, for furnishing and laying service pipes from the lot line to the meter, not to exceed 10 cents per lineal foot. No rent or other charges shall be made to consumers for the use of meters or for any other purpose, except as this ordinance provides. *Sec.* 12. The manufactured gas to be furnished by said Company under the terms and upon the conditions prescribed in this ordinance shall be merchantable gas of not less than 18 candle power; that is, of such quality as that a burner consuming 5 feet thereof per hour, at a pressure not exceeding two tenths of an inch at the photometric burner (which burner shall be of the lava-tipped Bunsen-Argand pattern), shall give a light as measured by the photometric apparatus in ordinary use of not less than 18 standard candles, each consuming 120 grains of sperm per hour, to be determined by the monthly average of semi-weekly tests, to be made by the proper officer of the city government, to be designated by the Board of Public Works, at places of not more than one mile distant from any of the works of said Company, the results of which said tests shall be communicated to the said Company within 24 hours after the same shall have been made. If the average of said semi-weekly tests for any month shall fall below 18 candle power as herein provided, then the amount to be charged for gas to consumers during said month shall be reduced pro rata, and the said gas shall be delivered at the burner of the consumer at such pressure in the mains as shall be consistent with the proper distribution of gas throughout the entire system of mains in the city, and the degree of the said pressure shall be at all times wholly subject to and under the direction and control of the Board of Public Works. All governors, meters and works of said Company shall be at all times subject to the inspection of the proper officer, to be designated by the Board of Public Works for such purpose. Any meter or other apparatus of said Company which may be condemned by said Board of Public Works as incorrect or unreliable, shall be forthwith removed by said Company. *Sec.* 13. The Board of Public Works, by its authorized agent, shall have the right to remove any meter of said Company from he premises of any consumer for the purpose of testing the same. Said 'Company shall be required, whenever deemed necessary by said Board of Public Works, to supply to any consumer, whose meter may be removed for inspection, another meter for use during the time required for such inspection. Any consumer of gas in said city shall have the right, on paying to said Board of Public Works a fee of $1, to have his meter inspected, and may be present at any such test if he so desires. If any such meter on being tested shall be found to register inaccurately to the injury of the consumer to an extent exceeding 2 per centum, the fee of $1 paid by such consumer for such inspection shall be returned to the consumer by said Company. The officer making the inspection shall mark such meter as fast, and said Company shall not allow the same to be used until the defect is remedied, the meter again inspected by said officer, found to be correct and so certified. Every such meter shall be considered correct, and sealed accordingly, which shall register quantities varying from the true standard measure of gas not more than 2 per cent., and a record shall be kept of the same and of all fees so collected. Whenever a consumer shall have his meter tested as above provided, and the same shall be found correct, then said inspection fee shall not be returned, but shall be equally divided between the city and said Detroit Gas Company. All meters hereafter placed by said Detroit Gas Company shall, whenever required by the Board of Public Works, be first inspected, proved and sealed by the agent of said Board. All tests of meters shall be made with the standard meter provers in ordinary use." The remaining sections (10 in number) provide, among other things, for the returns, and the manner of making the same, to be semi-annually made to the authorities of the standing and accounts of the Company; the length of life of the franchise (14 years); a specification that the Company shall pay annually to the city the sum of 5 per cent. on its gross income; a provision for the taking over by the city of the works, should it so elect, at the end of 14 years, and the manner in which the value of the works shall be arrived at—by arbitration; and other routine details.

Testing Coal by Electricity.

The *Electrical Review*, in commenting on a new method of testing coal, remarks: It is not. perhaps, too great a flight of imagination to assign this title to a method which W. Hempel has recently devised for use in determining the character of coal. Sulphur is a troublesome constituent which the gas companies would rather have absent from than present in the coals; moreover, it seriously impairs the quality of the gas produced. W. Hempel is one of the leading authorities on coal gas in Germany, and he has recently adopted a method, first devised in more complex form by Berthelot, whereby the sulphur in coals may be estimated, and hence their suitability for gas making determined before purchase. In doing this he has taken advantage of the cosmopolitan aid which electricity offers. The coal to be tested is powdered and pressed into a little platinum wire cylinder, to which a long platinum wire is attached, and then burned. The combustion is effected in an ordinary glass bottle, which is fitted with a trebly perforated India-rubber stopper. Through this passes a tube with a glass stopcock, and which widens out into a cylinder; also two glass tubes, to the lower ends of which are fused two long thick platinum wires. One of these wires carries the little platinum cylinder or basket already referred to. A little mercury is poured into the tube so as to establish sure contact with wires which lead the electricity. When the current is passed the platinum basket becomes white hot, the combustion of the coal is effected, and the gaseous products containing the sulphur compounds are led off through the stopcock and examined chemically. This method is exceedingly neat and gives, it is said, very satisfactory results, which enable the character of the coal to be accurately determined.

A Coal Dust Engine.

A novel motive power engine has been invented, based upon the fact that very finely divided carbon, floating in the air, readily explodes, and to adapt this to the generation of motive power the inventor proposes to grind coal to an impalpable powder, and, after introducing the dust floating in the air into the cylinder of an engine, explode it, the idea being to follow very much the same lines which are being so thoroughly developed in the use of gas in engine practice. The first difficulty which suggests itself is how the ash is to be got rid of, but experience in gunnery shows that this may not be a serious obstacle.

The Market for Gas Securities.

The brakes came off Consolidated gas with a vengeance this week, the opening bid price today (Friday) being 123, as against 117 on Friday last. Quite some business was done in it during the week on the Exchange, and judging from the generally expressed opinion it is likely that Consolidated will never again sell down to the figures quoted in it some time ago, or during the worst of the recent depression. Equitable is in the vicinity of 170 bid, and Mutual shows no change. Standard preferred is steady to strong. We would advise the purchase of these shares at the quoted figures, for it is not at all impossible that the dividend rate will be increased in the near future.

In Brooklyn securities no change is noted, although a sale at auction of 53 shares Citizens is reported to have taken place at the very improbable figure of 64½. The Fulton-Municipal Company is going on with its pipe laying in the district of the Williamsburgh Company, and it is likely that we are to have a rate war. Such squabbles put one in mind of the days of callow youth. The Equity is reported ready to connect up its services. Chicago gas is stronger, at 53½ to 53¾. The Directors have declared a scrip dividend for the past quarter of 1½ per cent., the same to bear 6 per cent. interest, and to be redeemable at the option of the Company. Baltimore Consolidated is up to 54, and is cheap. Bay State made a marked gain during the week. It is quoted at 17 to 18.

Gas Stocks.

Quotations by Geo. W. Close, Broker and Dealer in Gas Stocks,

16 Wall St., New York City.

September 4.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share. ☜

	Capital.	Par.	Bid	Asked
Consolidated	$35,430,000	100	123	125
Central	500,000	50	90	95
" Scrip	220,000	—	—	100
Equitable	4,000,000	100	145	155
" Bonds	1,000,000	—	106	108
Harlem, Bonds	170,000	—	—	—
Metropolitan, Bonds	658,000	—	110	115
Mutual	3,500,000	100	130	—
" Bonds	1,500,000	—	100	102
Municipal, Bonds	750,000		—	—
Northern		50	—	—
" Bonds	150,000	—	—	100
Richmond Co., S. I.	346,000	50	—	—
" Bonds	20,000	—	—	—
Standard Gas Co—				
Common Stock	5,000,000	100	30	40
Preferred	5,000,000	100	75	80
Yonkers		50	112	—
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	—	110
Citizens	1,200,000	20	—	105
" S. F. Bonds	320,000	1000	—	103
Equity Gas Light Co	2,000,000	100	—	—
Bonds	1,000,000	—	—	—
Fulton Municipal	3,000,000	100	—	120
" Bonds	300,000		102	—
Peoples	1,000,000	10	—	90
" Bonds (7's)	368,000	—	100	—
" " (6's)	94,000	—	100	—
Metropolitan	870,000	100	—	120
" Bonds (5's)	70,000	—	100	—
Nassau	1,000,000	25	—	150
" Ctfs.	700,000	1000	99	100
Williamsburgh	1,000,000	50	130	—
" Bonds	1,000,000	—	107	110
Out of Town Gas Companies.				
Boston United Gas Co.—				
1s Series S.F. Trust	7,000,000	1000	—	60
2d " " "	3,000,000	1000	40	—
Bay State Gas Co.—				
Stock	5,000,000	50	17	18
Income Bonds	2,000,000	1000	40	—
Buffalo Mutual, N. Y.	750,000	100	110	—
" Bonds	200,000	1000	95	100
Citizens, Newark	1,000,000	50	155	160
Chicago Gas Company.	25,000,000	100	53½	53¾
Chicago Gas Light. & Coke Co.—				
G't'd Gold Bonds	7,650,000	1000	85	90½
Equitable Gas & Fuel Co, Chicago, Bonds	2,000,000	1000	—	101
People's Gas and Coke Co., Chicago—				
1st Mortgage	2,100,000	1000	—	108
2d "	2,500,000	1000	104	105
Consumers Gas Light Co., Jersey City	2,000,000	100	—	25
Bonds	600,000	1000	—	85
Cincinnati G. & C. Co.	7,000,000	100	192	—
Consumers Toronto	1,600,000	50	190	191
Central, S. F., Cal			—	100
Capital, Sacramento, Cal			—	55
Consolidated, Balt.	11,000,000	100	53¾	54
" Bonds	6,400,000		107	107½
Citizens Gas Lt. Co., Rochester, N. Y.	500,000	—	85	101
Bonds	250,000		—	—
Detroit Gas Co.—				
1st Mortgage			85	87

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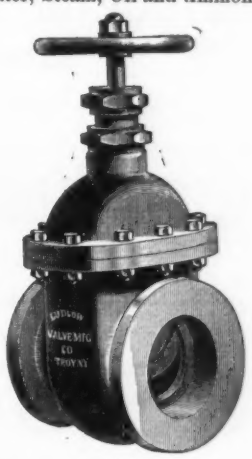

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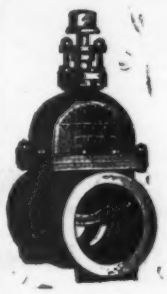

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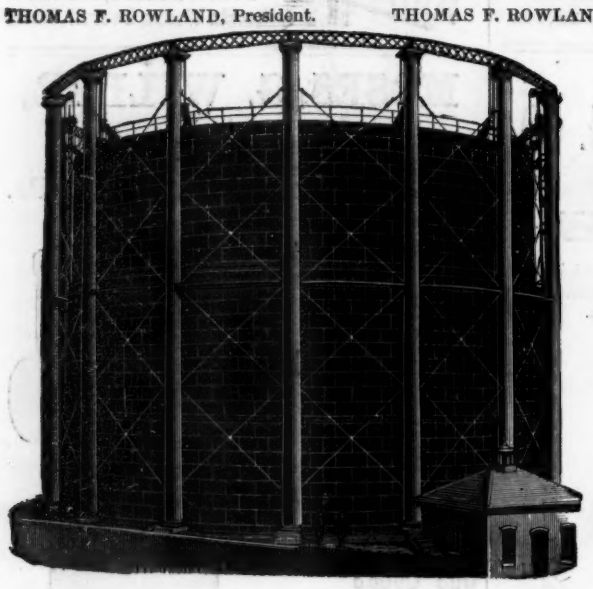

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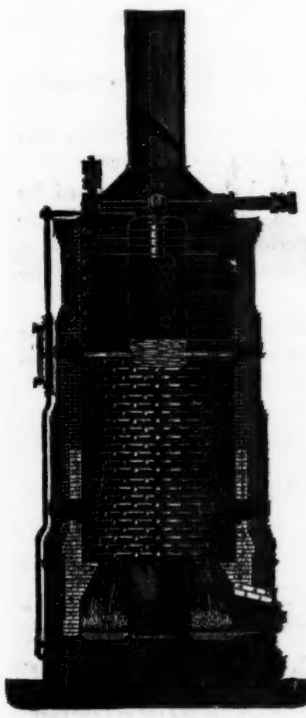

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We Solicit for it the Critical Examination of the Mechanical Profession and the Steam-Using Public.

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Standard Sizes,
50 H.P.
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500 H.P.

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For Export.

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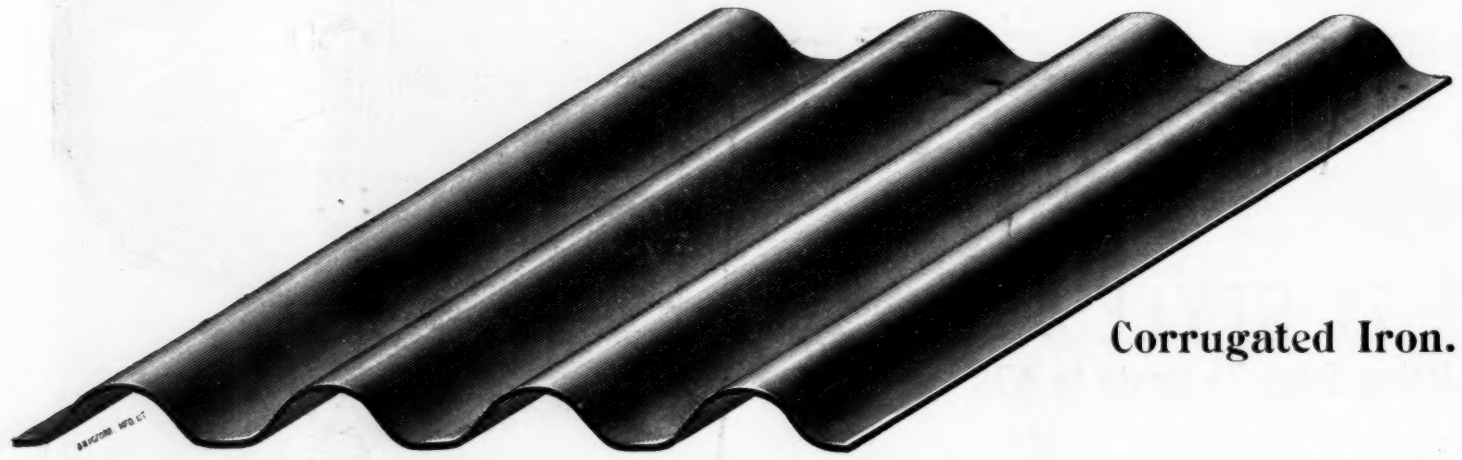

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	Candle Power.	Pressure.	Gas Consumed.	C.P. per Cu. Ft.
Average of Test No. 1,	67.05	.95 in.	2.6	25.70
" " No. 2,	63.86	1.00 in.	2.86	22.30
" " No. 3,	72.50	2.1 in.	2.87	25.26

The above averages are the results of trials on three different occasions, and in each case the mantles tested were made from a different lot of fluid.

The mantles used in the above tests were selected at random, and all had been dipped in kristaline and dried ready for shipment.

It is quite possible that better results could have been obtained by manipulating and readjusting the position of the mantles on the galleries, and also by waiting a longer period after burning off the kristaline; but I considered such fine adjustment undesirable in determining the commercial candle power.

These tests were made on a bar photometer against a regular Edgerton standard slit. The candle power of the slit was 6.18, and the gas used was Gloucester City water gas, 26 candle power.

Very truly yours,
(Signed) C. H. PAGE, JR., M.E.

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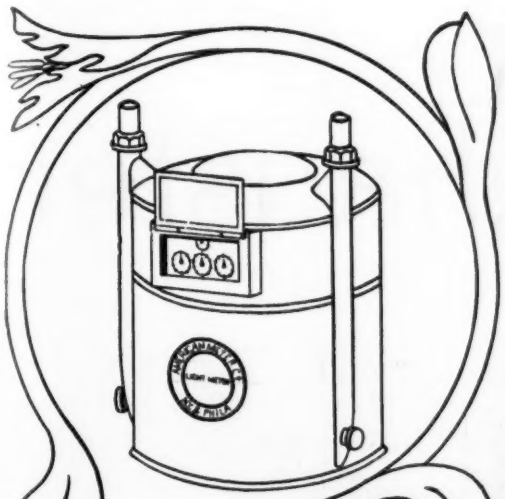

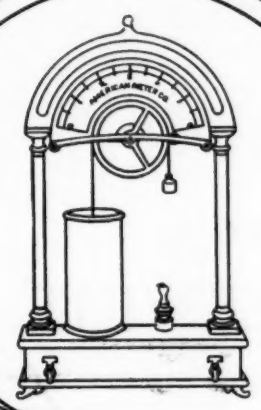

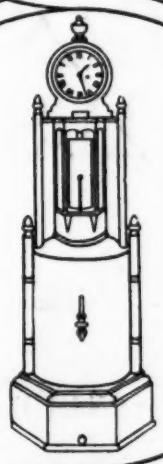

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ST. LOUIS, SAN FRANCISCO.

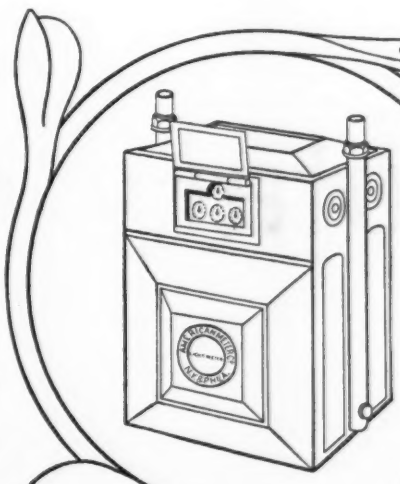
PUBLIC LIGHTING TABLE,

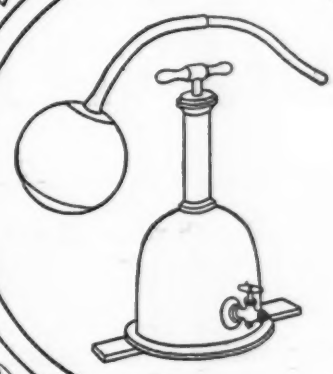
SEPTEMBER, 1893.

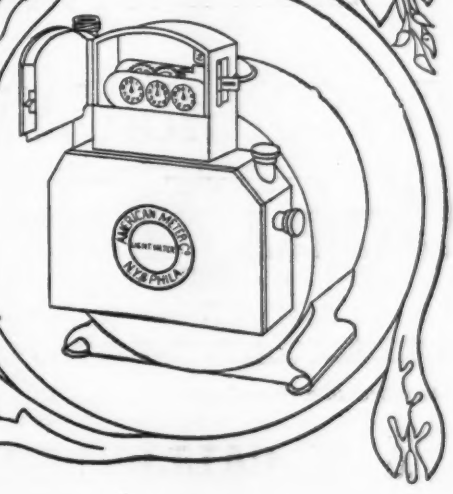
Day of Week.	Date.	Table No. 1. Following the Moon. Light.		Extinguish.		Table No. 2. New York City. All Night Lighting. Light.	Extinguish.
						P.M.	A.M.
Fri.	1	7.00	PM	10.10	PM	6.30	4.20
Sat.	2	7.00		11.00		6.30	4.20
Sun.	3	7.00	LQ	11.40		6.15	4.30
Mon.	4	7.00		12.40	AM	6.15	4.30
Tue.	5	7.00		1.50		6.15	4.30
Wed.	6	6.50		3.10		6.15	4.30
Thu.	7	6.50		4.30		6.15	4.30
Fri.	8	6.50		4.30		6.15	4.30
Sat.	9	6.50		4.40		6.15	4.30
Sun.	10	6.50	NM	4.40		6.05	4.40
Mon.	11	6.50		4.40		6.05	4.40
Tue.	12	6.40		4.40		6.05	4.40
Wed.	13	6.40		4.40		6.05	4.40
Thu.	14	6.40		4.40		6.05	4.40
Fri.	15	7.40		4.40		6.05	4.40
Sat.	16	8.20		4.40		6.05	4.40
Sun.	17	9.00	FQ	4.40		5.55	4.50
Mon.	18	9.50		4.40		5.55	4.50
Tue.	19	10.50		4.50		5.55	4.50
Wed.	20	11.50		4.50		5.55	4.50
Thu.	21	1.00	AM	4.50		5.55	4.50
Fri.	22	2.10		4.50		5.55	4.50
Sat.	23	3.10		4.50		5.55	4.50
Sun.	24	No L		No L.		5.40	5.00
Mon.	25	No L	FM	No L.		5.40	5.00
Tue.	26	No L		No L.		5.40	5.00
Wed.	27	6.20	PM	7.50	PM	5.40	5.00
Thu.	28	6.20		8.20		5.40	5.00
Fri.	29	6.20		8.50		5.40	5.00
Sat.	30	6.20		9.40		5.40	5.00

TOTAL HOURS LIGHTING DURING 1893.

By Table No. 1.	Hrs.Min.	By Table No. 2.	Hrs.Min.
January...	217.30	January...	423.20
February..	200.30	February..	355.25
March	177.50	March	355.35
April.....	160.30	April.....	298.50
May.....	149.00	May.....	264.50
June.....	140.30	June.....	234.25
July.....	143.40	July.....	243.45
August....	154.50	August....	280.25
September.	171.50	September.	321.15
October....	202.20	October....	374.30
November.	221.30	November.	401.40
December.	248.50	December.	433.45
Total..	2188.50	Total..	3987.45







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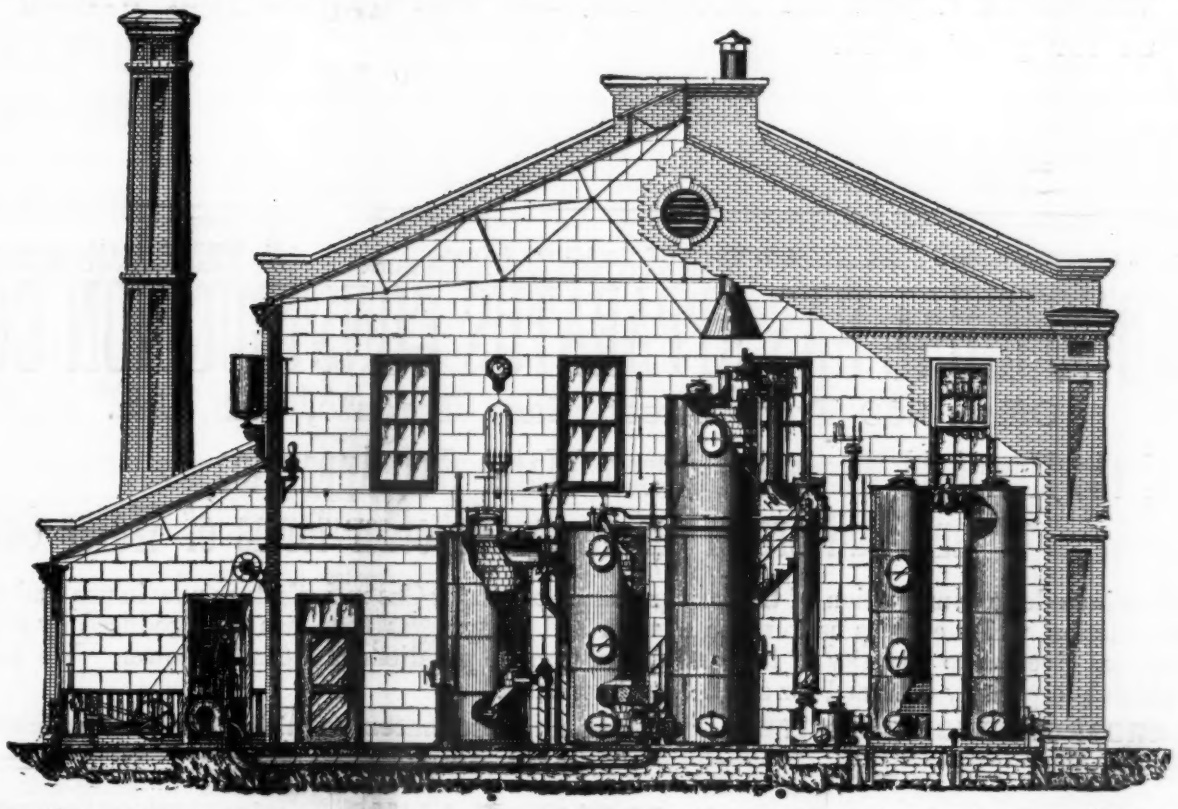

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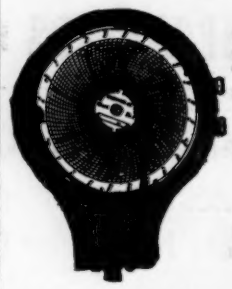

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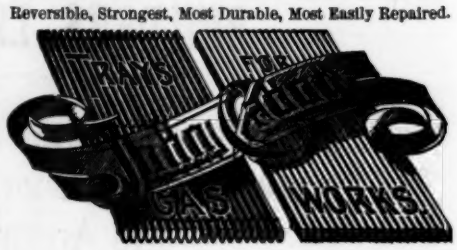

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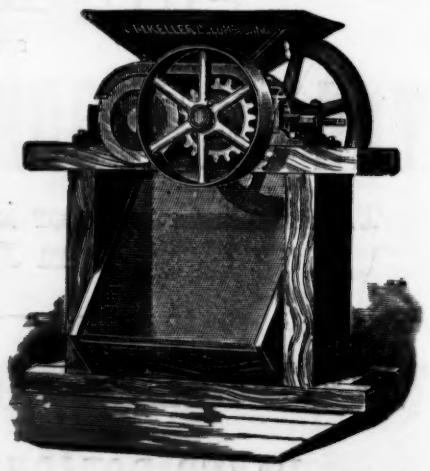

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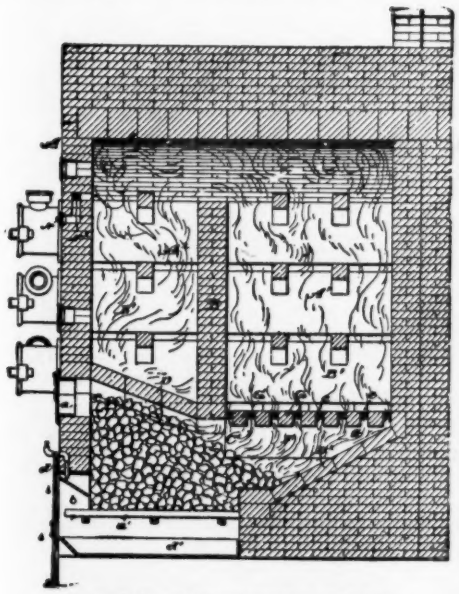

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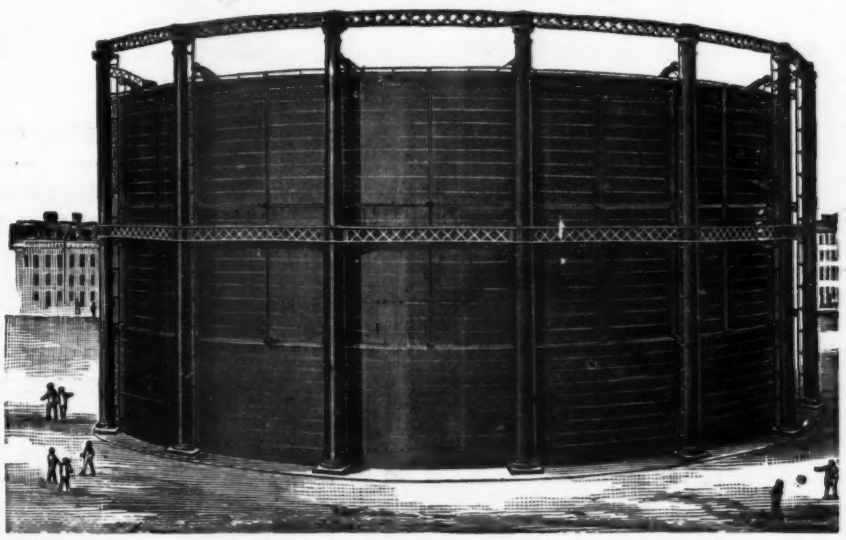

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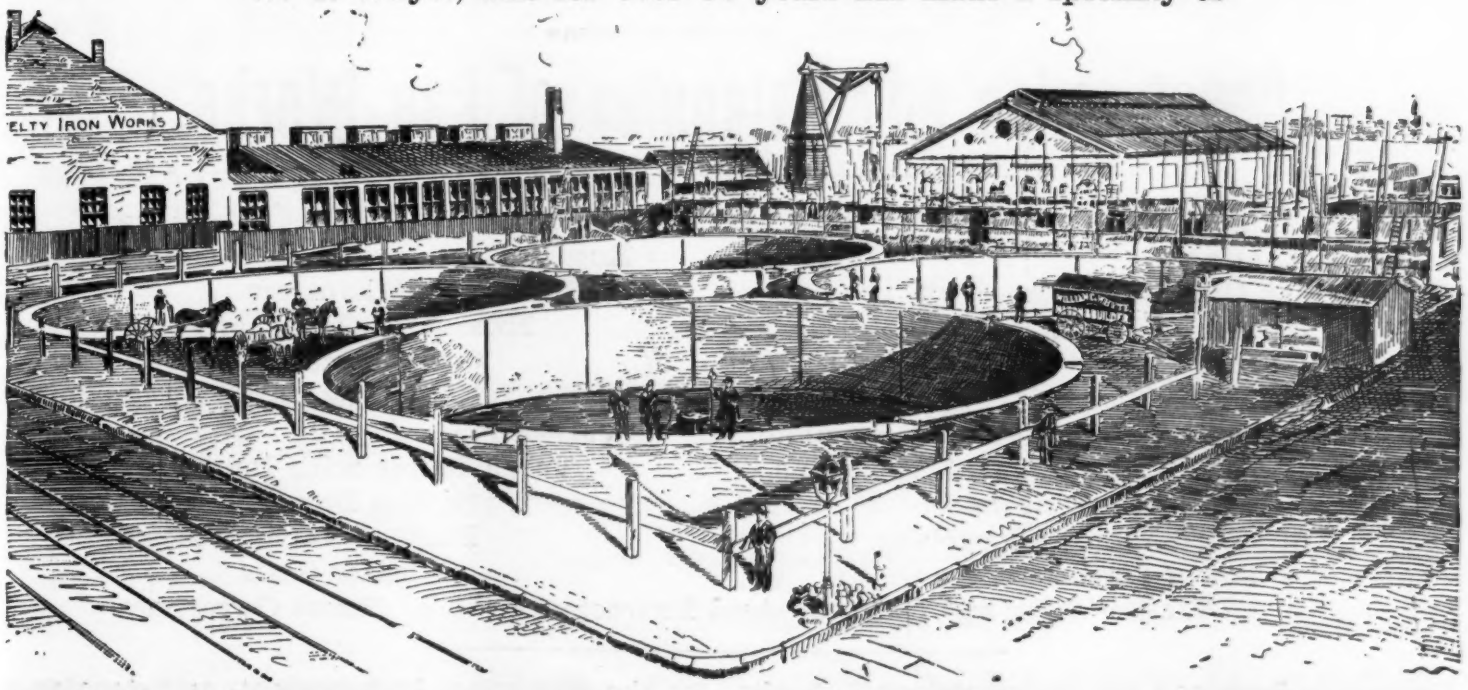

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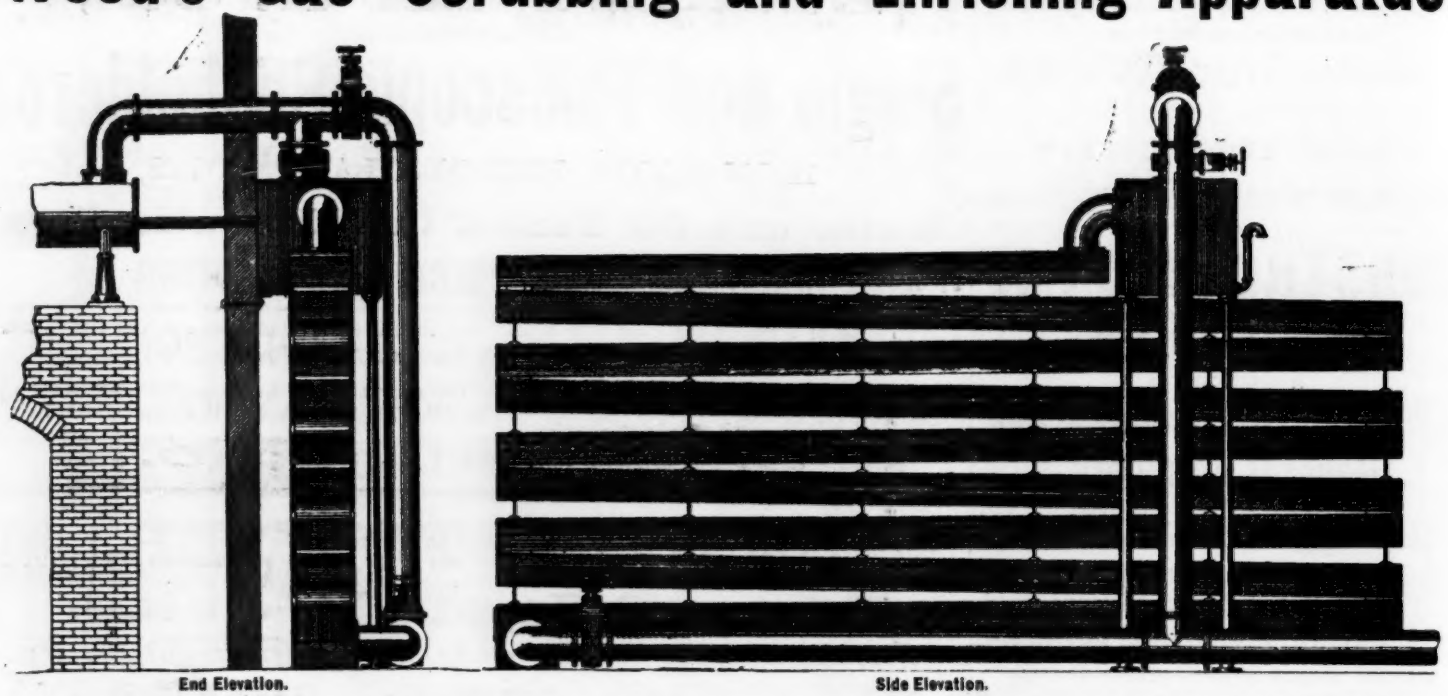

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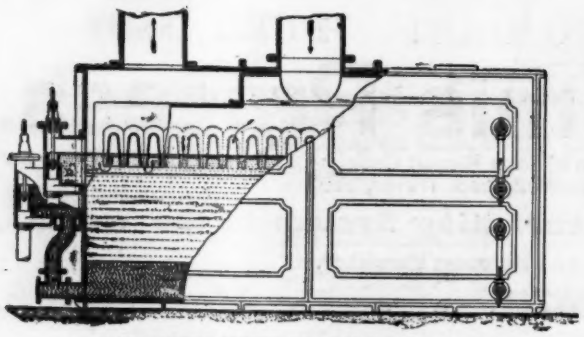

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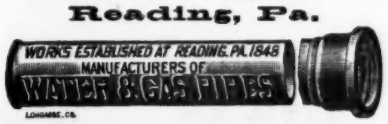

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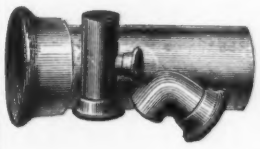

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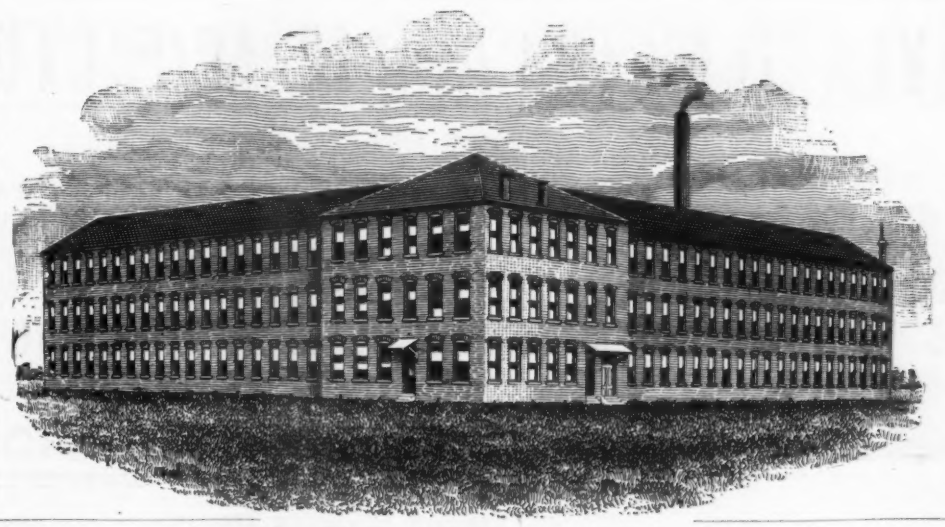

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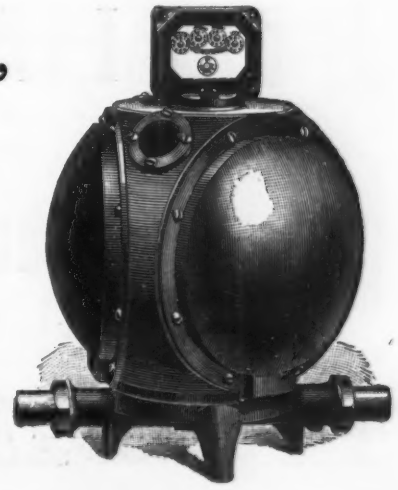

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EXPERIMENTAL METERS, SHOW OR GLAZED METERS,

Pressure and Vacuum Registers, Gauges, Photometers, Drip and Bell Pumps, Etc., Etc.

PROMPT ATTENTION GIVEN TO ALL ORDERS. METERS THOROUGHLY REPAIRED. ESTIMATES FURNISHED FOR STATION METERS OF ALL SIZES. CORRESPONDENCE SOLICITED.

GAS METERS. GAS METERS. GAS METERS.

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THE AMERICAN METER CO.

Established 1834. Incorporated 1863.

WET AND DRY GAS METERS. PRESSURE REGISTERS. METER PROVERS.
STATION METERS. PRESSURE & VACUUM REGISTERS. PORTABLE TEST METERS.
EXHAUSTER GOVERNORS. PRESSURE & VACUUM GAUGES. EXPERIMENTAL METERS.
DRY CENTER VALVES. CRESSON GAS REGULATORS. AMMONIA TEST METERS.
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GAS STOVES.
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GAS METER MANUFACTURERS,

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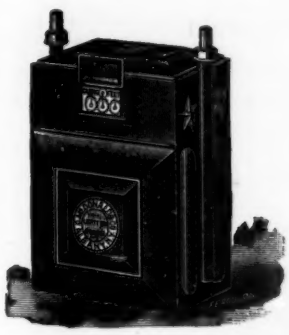
WET AND DRY GAS METERS, STATION METERS, EXPERIMENTAL METERS, METER PROVERS,

Center Seals, Pressure Registers, Governors, Indicators, Photometers, and all other kinds of Apparatus for use in Gas Works

FOULIS' PATENT STATION AND DISTRICT GOVERNORS.

REPAIRING DEPARTMENT.—We employ a special force of skilled workmen repairing meters of **all makers.**



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Established 1854.

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MANUFACTURERS OF

Wet and Dry Gas Meters

STATION METERS, EXPERIMENTAL METERS, METER PROVERS, PRESSURE & VACUUM REGISTERS & PRESSURE GAUGES.

Meters of all makers Thoroughly Repaired.

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DRY GAS METERS.
STATION METERS.
METER PROVERS.
REPAIRING.

SPECIAL.—Having purchased the sole right to manufacture and sell meters with the HEARNE IMPROVED VALVE, in the U. S., we respectfully solicit orders for the same.

The superior feature of this meter is that it avoids the danger of displacement of the valves, and consequent loss of gas, either in shipping, handling, or by dishonest consumers.

To designate from the regular Glover Meter also made by us, we style the above the HEARNE-GLOVER Meter.

It is worth your consideration.

Full descriptive circular sent on application

$10,500,000

Is the estimated value of Gas consumed per year by

35,000 "OTTO" GAS ENGINES

NOW in use . . . . . .

To what extent does **Your Company** participate in this amount?

If you have not reached out for your share, it is time **now** to do so—for many good reasons:

1st. Because rates on Electric current are on the increase.

2d. Because improvements in our "Otto" Gas Engines have been wonderful and numerous, and have cheapened their cost.

3d. Because prices for Gas are lower than ever before.

4th. Because you can therefore make a price for Fuel Gas sufficiently low to leave you master of the situation as regards competing systems of power—steam or electricity.

WILL IT PAY?

Mr. Thomas Fletcher, well known in the Gas Industry, gives his opinion on this question as follows

"It is essential for economical working, and consequent low prices, that the plant as a whole shall be utilized as far as possible for the whole 24 hours every day, summer and winter alike. If this ideal state of things could be attained, about three or four times the output could be sold with practically no addition to the capital expenditure, *and consequently the profits would be increased to four or five times the present amount*, or even more, as the staff expenses would not rise in proportion, an account of £25 being quite as easy to deal with as one of £5, and requiring no additional office work. Instead of being the best customers, *shopkeepers* and *owners of large works* are really *the worst* the gas industry has to deal with, spite of the large total amount, and the reason is simple. The consumption is enormous during two or three hours in winter, entailing the necessity of enormous holders and very large distributing plant, all of which is absolutely idle during the summer. THE BEST OF ALL CUSTOMERS ARE THOSE WHO USE GAS FOR ENGINES, workshop and industrial purposes, as these will use a steady supply for about ten hours daily, winter and summer alike, and *these are the users worthy of the greatest consideration.* Next to these come the users of gas cooking appliances and gas fires, they also being practically steady users for long hours both in the winter and summer. Domestic lighting does not come out anything so favorably, as the consumption in the winter averages over double that in the summer, entailing the loss on idle plant during a large portion of the year. The dream of the gas engineer is a large summer and 'day gas' consumption, and on *these depend large profits and economical working.*"

REDUCED PRICES AND FULL PARTICULARS ON APPLICATION.

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